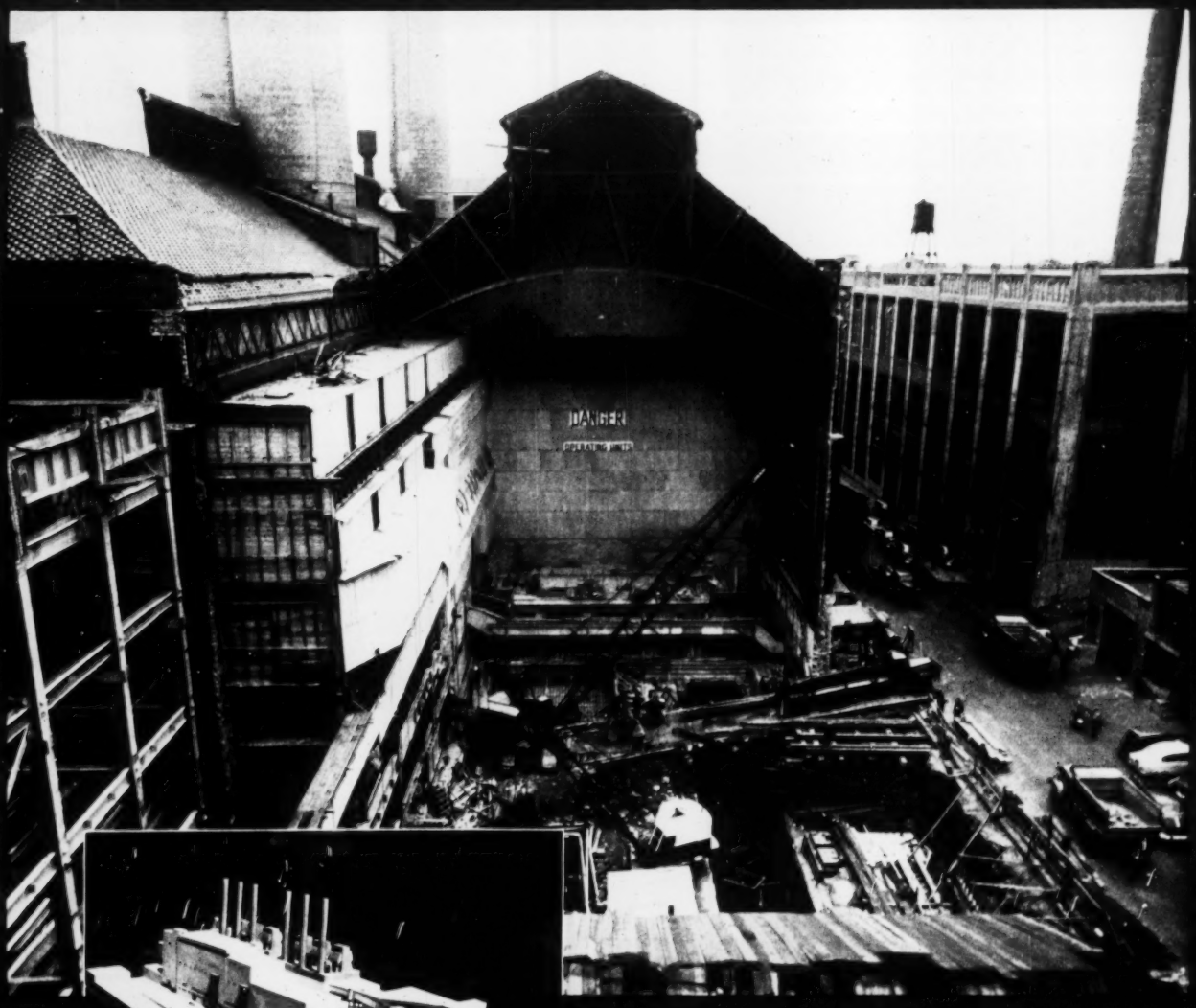
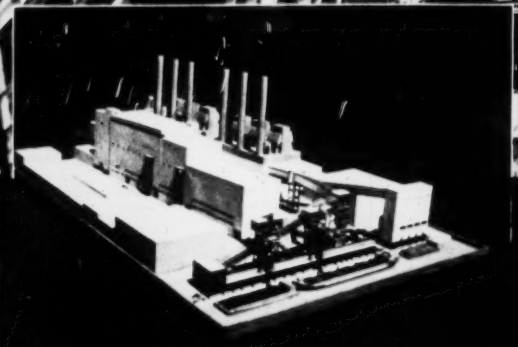
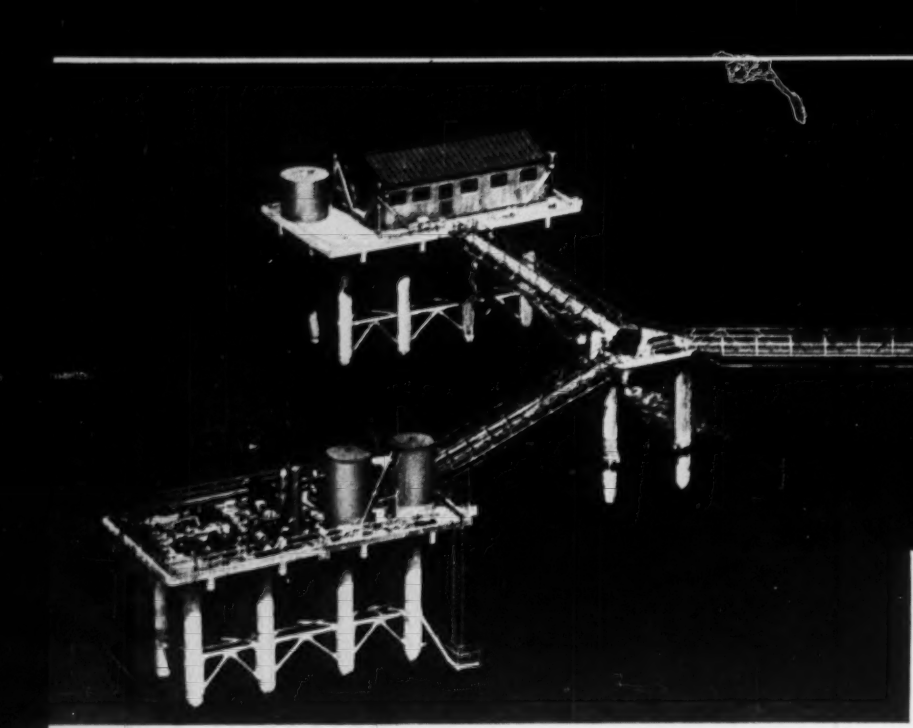
CIVIL ENGINEERING



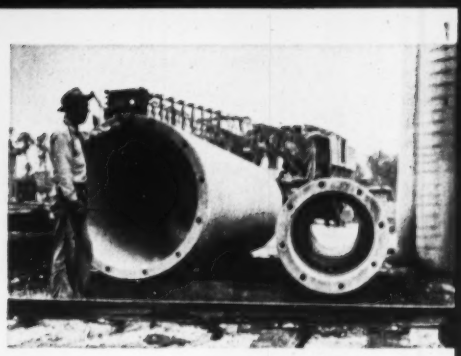


MODERNIZING A 50-YEAR-OLD POWER PLANT

Complications in 45-million-dollar renovation program include constricted space and need to keep old plant in continuous operation, to supply power to New York City subways. See article by M. P. Aillery.



Oil production platform in Gulf of Mexico on 36" Raymond Cylinder Piles.



Two typical pile sections.

THE Raymond
PRESTRESSED CONCRETE CYLINDER PILE

Raymond, pioneer in concrete piles, announces its latest construction development, the CYLINDER PILE, which is ideally adapted for use in off-shore projects, piers, bridges, and similar construction. This pile is a hollow cylindrical pile of prestressed concrete, manufactured in a series of sections placed end to end and joined together by post-tensioned cables of high tensile steel wire . . . The advantages over other types of piles are numerous. Prestressed Cylinder Piles have extraordinary structural strength. They are fireproof, corrosion-proof and not subject to attack by marine organisms, thus assuring low maintenance and extremely long life. In addition, their flexibility as to length, diameter and extent of prestressing makes it possible for them to meet a wide variety of design requirements.

SEND FOR BULLETIN CP-1

Assembling of the pile sections.
Raymond Cylinder Piles are made in lengths up to 200 feet

BRANCH OFFICES in principal cities of the United States, Canada, and Central and South America

Raymond
CONCRETE PILE CO.

140 CEDAR STREET • NEW YORK 6, N. Y.

This section of **CLAY PIPE** has just taken the 500-YEAR TORTURE TEST!

SCIENTISTS at the N.C.P.M.I. research laboratories in California have been trying for years to find some worn-out Clay Pipe. They wanted just one worn-out length, so they could study it and determine how to make it better.

They looked everywhere. They dug up Clay Pipe that had been in service for 50, 100, and 150 years — but it was still in first-class condition. They wrote letters to all parts of the country, without success. Finally they decided to wear out a brand-new section in the lab.

Clay Pipe in service is often subjected to alkaline ground waters — so they boiled it in a concentrated solution of corrosive alkali. Then they soaked the same length in sulphuric acid for a week, to duplicate the corrosive effects of sewage gases. For good measure, they ran a stream of hydrochloric acid through it for another week. Then they half filled it with gravel, plugged up the ends, and put it in a machine that shook it like a cocktail, to see what effect years of abrasion might have on the inner walls. They soaked it in successive solutions of hot detergent, sea water, and the 16 most common industrial wastes.

After the test — roughly equal to 500 years of sewerage torture — they checked its dimensions, absorption, and crushing strength. *It was still as strong and round, as hard and smooth, as the day it was made.*

In the lab or in the ground, Clay Pipe is the *only* pipe that never wears out. Insist on it when you want permanent sewerage protection.

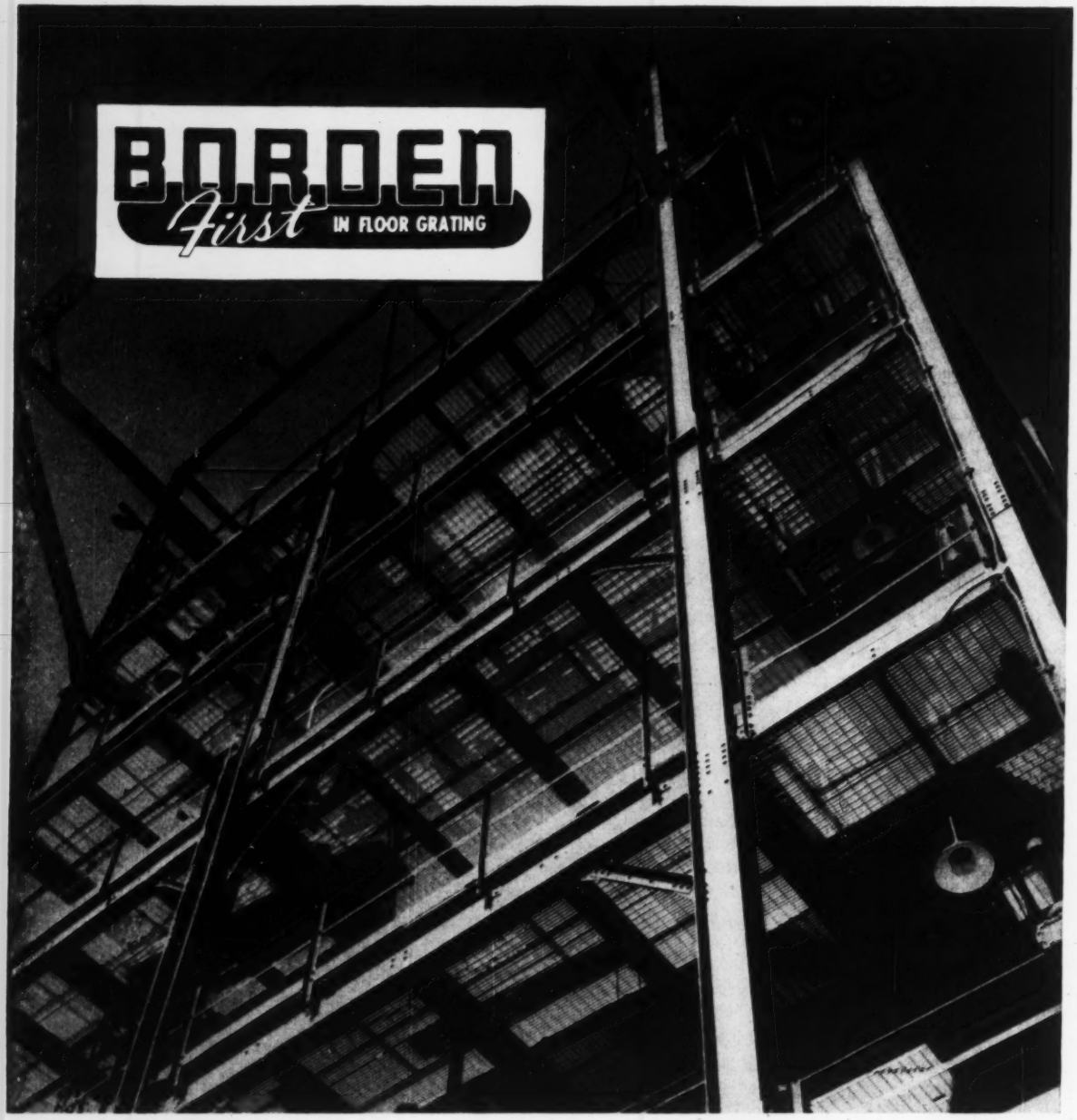
NATIONAL CLAY PIPE MANUFACTURERS, INC.
1520 18th St. N.W., Washington 6, D. C.

311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

Vitrified
CLAY
PIPE
NEVER WEARS OUT!

C-1054-1

CIVIL ENGINEERING, November 1954. Vol. 24, No. 11. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at ASCE Headquarters, 33 West 39th St., New York 18, N.Y. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under Act of August 24, 1912, and accepted for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 5, 1918.



BORDEN MANUFACTURES EVERY TYPE FLOOR GRATING

IN FERROUS AND NON-FERROUS METALS

BORDEN ALL-WELD DESIGN

The best type for use where floors are subject to extreme corrosion or moisture — chemical plants, breweries and other process industries. There are no cracks, open joints, or holes in bars. This type made only in mild steel.

BORDEN RIVETED DESIGN

Most substantial and oldest design of grating made, permits perfect distribution of loads. Made on the truss principle, Borden Riveted Gratings are hydraulically power-forged for strength and durability. Particularly recommended for aluminum.

BORDEN PRESSURE LOCKED DESIGN

Neat, clean, durable, easy to paint and maintain. Pressure Locked Design permits maximum passage of light, heat and air. It is especially desirable in power plants, boiler rooms and all dry area. Deep cross bars increase lateral support.

SEND FOR FREE CATALOG COVERING ALL FLOOR GRATINGS

BORDEN METAL PRODUCTS COMPANY

854 GREEN LANE Elizabeth 2-6410 ELIZABETH, N. J.

SOUTHERN PLANT -- LEEDS, ALA. — MAIN PLANT—UNION, N. J.

Editor • Walter E. Jessup
Executive Editor • Robert K. Lockwood
Associate Editor • Ruth G. Campbell
Assistant Editor, News • Mary E. Jessup
Assistant Editor, Production • Doris A. Braillard
Advertising Manager • James T. Norton

EDITORIAL & ADVERTISING DEPARTMENTS at ASCE Headquarters, 33 West 39th Street, New York 18, N. Y.

Advertising Representatives
are listed on Index to Advertisers page

ASCE BOARD OF DIRECTION

President

William Roy Glidden

Vice Presidents

Louis R. Howson — Enoch R. Needles
Mason G. Lockwood — Frank L. Weaver

Directors

A. A. K. Booth — W. S. LaLonde, Jr.
E. W. Carlton — C. B. Molineaux
Don M. Corbett — Samuel B. Morris
F. M. Dawson — Carl G. Paulsen
Raymond F. Dawson — Frederick H. Paulson
L. A. Elsener — George S. Richardson
Jewell M. Garrelts — Thomas C. Shedd
Oliver W. Hartwell — M. J. Shelton
G. W. Holcomb — G. P. Willoughby
Lloyd D. Knapp

Past Presidents

Walter L. Huber — Daniel V. Terrell

EXECUTIVE OFFICERS

Executive Secretary • William N. Carey
Assistant Secretary • E. Lawrence Chandler
Treasurer • Charles E. Trout
Assistant Treasurer • George W. Burpee

The Society is not responsible for any statements made or opinions expressed in its publications.

Subscription Rates—Price 50 cents a copy. $5.00 a year in advance; $4.00 a year to members and to libraries; and $2.50 a year to members of Student Chapters. Canadian postage 75 cents, and postage to all other countries outside of the United States and possessions, $1.50 additional.

Printing—Reprints from this publication may be made on condition that full credit be given to the author, copyright credit to Civil Engineering, and that date of original publication be stated.

Copyright, 1954, by the American Society of Civil Engineers. Printed in U.S.A.

Member Audit Bureau of Circulations
42,500 copies of this issue printed

CIVIL ENGINEERING

NOVEMBER 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• CONTENTS • VOLUME 24 • NUMBER 11

Emerson C. Itschner	33	St. Lawrence Seaway and Power Projects started
William Roy Glidden	40	New President deals with current Society issues at inaugural
James R. Kelsey *Frederick T. Comstock*	42	Heavy building and crane loads carried by 100-ft K-trusses
William B. Poor	44	Competition stresses economics in gas pipeline transmission
C. W. Stickler, Jr. *A. Allan, Jr.*	46	Chemical sealing stops leakage in tunnels of Pennsylvania Turnpike
D. Lee Narver	49	Good concrete with coral and sea water—II. Use of sea water
William J. Carroll *Chairman*	53	The young engineer looks at his economic position—committee report
Marcel P. Aillery	56	New York Transit Authority modernizes steam-electric plant
Dana E. Low	62	Finding angle-reading errors in long traverses
Ralph W. Powell	62	Resistance to flow in smooth pipes found directly
A. F. Lehman *J. M. Robertson*	64	Theodolite found useful in hydraulic testing

• SOCIETY NEWS

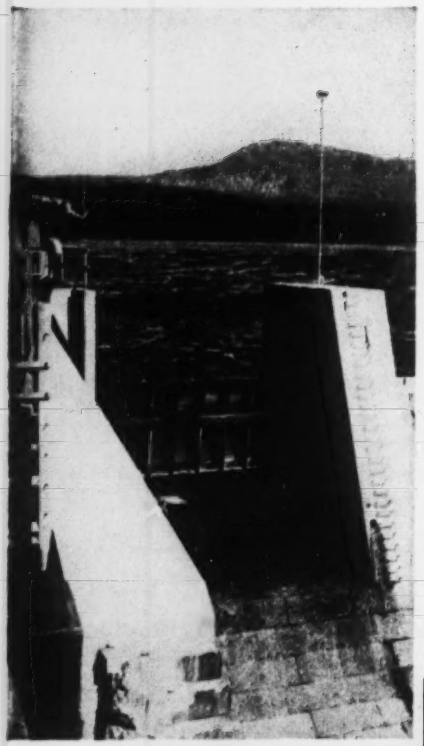
	66	Memorable program marks Society's 1954 Annual Convention
	69	Actions of ASCE Board of Direction briefed
	70	Committee on Budget makes recommendations to Board
	72	W. H. Wisely to succeed W. N. Carey as Executive Secretary
	72	Hoover Medal awarded to Alfred P. Sloan, Jr.
	72	John Fritz Medal goes to electrical engineer
	73	Notes from the Local Sections
Joseph H. Ehlers	75	From the Nation's Capital

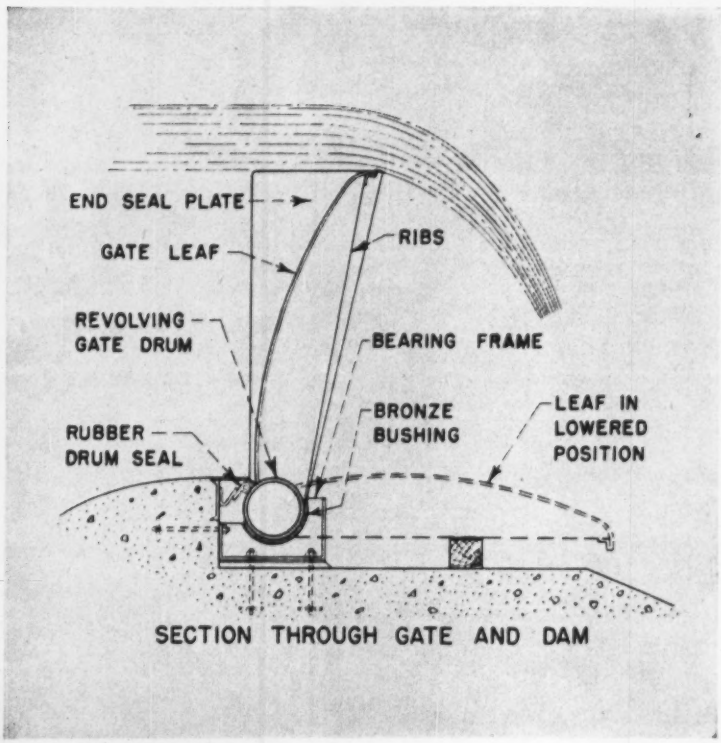
• NEWS BRIEFS

76	Another record building year predicted for 1955
76	More Colorado River water for San Diego
77	AISC awards prizes for beautiful bridges opened to traffic
78	Third quarter construction outlays reach new high
80	AGC nominates new officers and takes action on industrial problems at mid-year meeting
82	Nuclear Notes

• DEPARTMENTS

22	News of Engineers	107	Recent Books
27	Non-ASCE Meetings	110	New Publications
31	Do You Know That	112	Men and Jobs Available
62	Field Hint	113	Positions Announced
62	Engineers' Notebook	114	Applications for Admission
65	The Readers Write	116	Equipment, Materials, and Methods
73	Scheduled ASCE Meetings		
84	N. G. Neare's Column	121	Literature Available
103	Deceased	122	Films Available
106	New in Education	128	Index to Advertisers
123	Proceedings Papers available as Separates		





SMS

BASCULE CREST GATES

DO YOU NEED MORE WATER STORAGE— MORE CONTROL OR SPILLWAY CAPACITY...

Raising the water level is often the most economical way to meet increased demands on water and power supply. This problem can be quickly and economically solved on existing dams with a Bascule Crest Gate. Advantages of the SMS-Bascule are the speed and ease of operation for flood control and for sluicing away debris and ice.

SMS-Bascule Gates are electrically or hydraulically operated by automatic and/or manual controls.

According to your needs, gates can be made in lengths up to 100 ft. and up to 10 ft. in height.

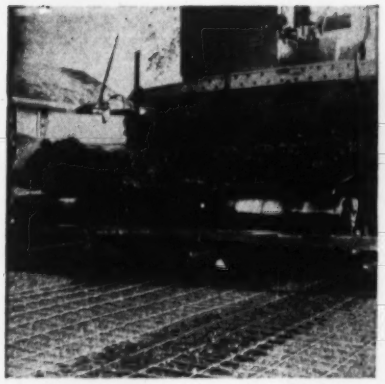
Hydrodynamics has been our specialty for over 75 years. For more information on hydraulic turbines, bascule gates and other accessories, write to the S .Morgan Smith Company, York, Pennsylvania.

Hydraulic Turbines
Pumps
Gates & Hoists
Trash Rakes
Accessories

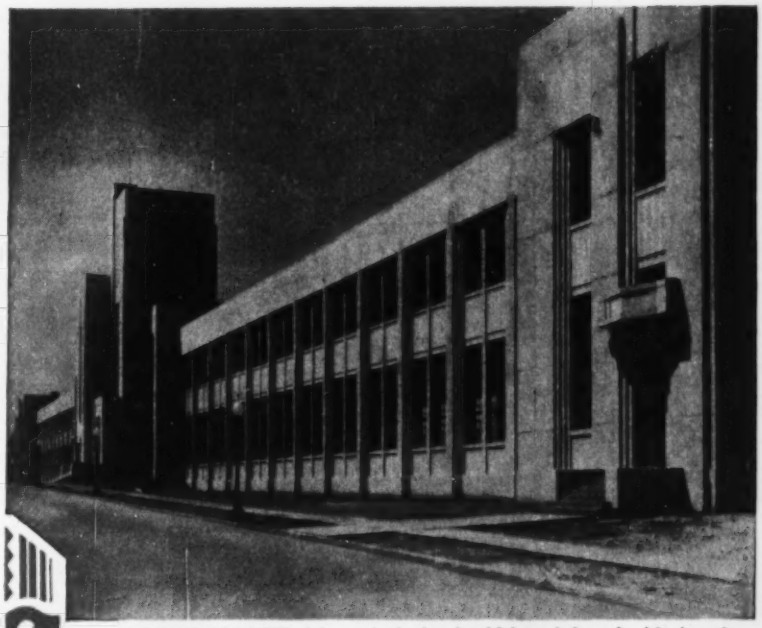
HYDRODYNAMICS

Rotovalves
Ball Valves
Butterfly Valves
Free-Discharge Valves
Controllable-Pitch Ship Propellers

S. MORGAN SMITH CO.



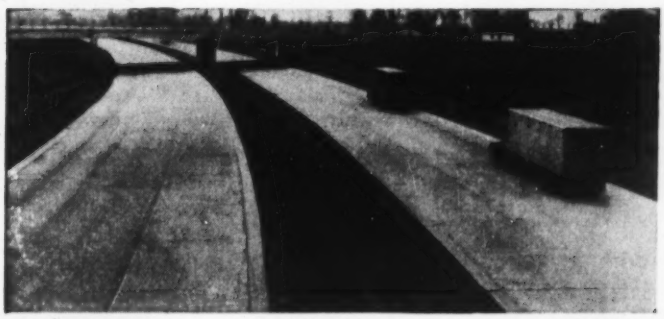
MANY APPLICATIONS of reinforced asphaltic concrete, some in service on test roads for many years, indicate that you should reinforce your next asphaltic concrete resurfacing job with American Welded Wire Fabric.



PRE-CAST CONCRETE slabs and planks should be reinforced with American Welded Wire Fabric. American Fabric is strong and light in weight, can be stressed about 40% higher than other types of reinforcement.

PREFABRICATED SHEETS of American Welded Wire Fabric provide a long lasting, smooth riding road surface. They are easy to handle.

New ASTM Specification A185-53T is only a starting point for American Welded Wire Fabric



CONCRETE HIGHWAYS can be built with longer slabs and fewer joints if they are reinforced with American Welded Wire Fabric.

WE don't work *up to* the new ASTM Specification A185-53T when we manufacture American Welded Wire Fabric. We consider these standards minimums, just as they were intended to be. And, while keeping our price competitive, we build as much extra strength and quality as we can. As a result, American Welded Wire Fabric surpasses ASTM specifications. It gives you extra assurance that your concrete structures will be every bit as strong as you design them.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO

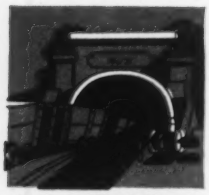
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS

TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

EVERY TYPE OF REINFORCED CONCRETE CONSTRUCTION NEEDS

USS AMERICAN WELDED WIRE FABRIC

UNITED STATES STEEL



Ore and Coal Mines

Coke Ovens

an integrated operation gives assurance plus of pipe quality

Blast Furnaces

Pipe Plants

U. S. cast iron PIPE

FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

U. S. Pipe and Foundry Co. is a wholly integrated producer of cast iron pressure pipe with our own mines, quarries, coke ovens and blast furnaces.

Thus we have complete and undivided control of every step in the production of basic raw materials used in making U. S. Cast Iron Pipe. Our integrated operation starts literally from the ground up.

In addition to being able to control the quality of pipe-making raw materials at their sources, our Quality Control of pipe production gives further assurance to customers that the quality level of U. S. Cast Iron Pipe is in excess of standard specifications. Our pipe is produced to our own quality control specifications, more exacting than the established specifications under which cast iron pipe is normally purchased.

U. S. PIPE & FOUNDRY COMPANY

GENERAL OFFICES: BIRMINGHAM 2, ALABAMA

A wholly integrated producer . . . from mines and blast furnaces to finished pipe.

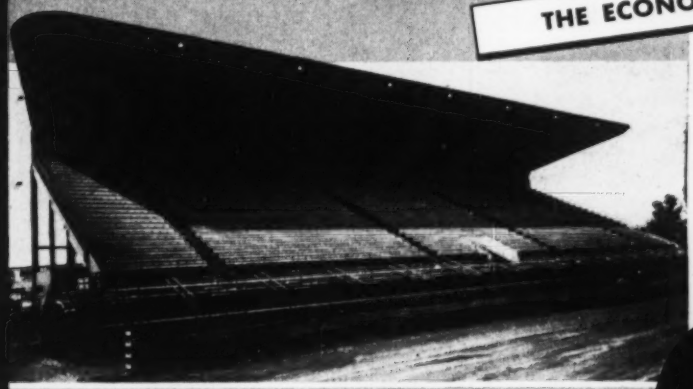
For every community need in modern outdoor seating

THE SAFETY OF STEEL

THE COMFORT OF CORRECT DESIGN

THE ECONOMY OF LONG LIFE

THE SATISFACTION OF FINE APPEARANCE



MERCED COUNTY, CALIF. Fairgrounds Stand. 2600 seats: four rows of box seats, 23 rows grandstand seats.

TROY, OHIO. One of two football stands, capacity 5,000 seats each. Note press box and enclosed underdeck area.

DES MOINES, IOWA. Baseball Stand. 2700 grandstand seats plus 500 box seats, totalling 3200 capacity.

Steel Deck Grandstands by PITTSBURGH • DES MOINES

In your present planning for improvement of spectator facilities for sports events in your municipality, you can be assisted greatly by the broad experience of Pittsburgh-Des Moines. We will be happy to counsel with you on your problems, and detail the time-proved adaptability of our unit-constructed Steel Deck Grandstands to every type of outdoor seating. Write today, and ask for your copy of our comprehensive Grandstand Brochure.

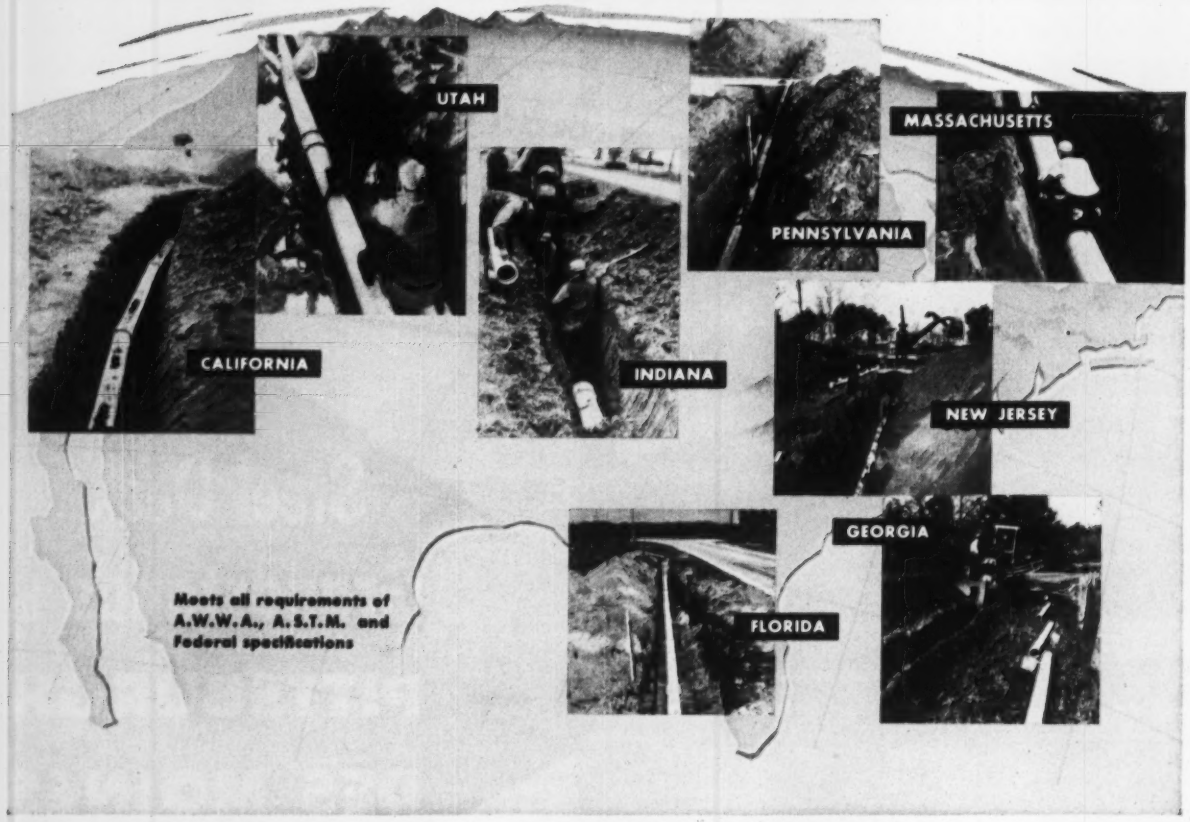
PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25) . . . . . 3470 Neville Island
NEWARK (2) . . . 251 Industrial Office Bldg.
CHICAGO (3), 1274 First National Bank Bldg.
LOS ANGELES (48), ... 6399 Wilshire Blvd.
DES MOINES (8), 971 Tuttle Street
DALLAS (1), 1275 Praetorian Bldg.
SEATTLE . . . . . 578 Lane Street
SANTA CLARA, CAL., 677 Alviso Road

Setting new standards–everywhere...



Transite Pressure Pipe and Ring-Tite Coupling speed water line assembly, lower installation cost

IN COMMUNITY after community, proof that Transite® Pressure Pipe and Ring-Tite® Coupling speed water line assembly and cut installation costs is reflected in such contractor comments as these:

"Exceeded by far, the speed anticipated under job conditions."

"Based bid on 400 feet a day, actually laid over 700 feet."

"Established an entirely new concept of installation savings."

These new records for speedy installation have been accomplished despite adverse terrain, weather conditions and the presence of muck and mud in many of these locations. That is why, whatever your water line problem it will pay you to learn all about Transite's many advantages.

* * *

Write for the new Transite Brochure, TR-142-A, Johns-Manville, Box 60, New York 16, N. Y.

JOHNS MANVILLE JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE

THE ASBESTOS CEMENT PIPE WITH THE NEW RING-TITE COUPLING

CUT LOADING COSTS WITH FAST-RUGGED EIMCO'S

Yes! You cut costs when you use Eimcos for loading.

NOTE these advantages:—

Advantage: Eimcos dig and load materials that are difficult or impossible for other loading equipment.

Reason: Eimcos are designed for tough jobs — digging and loading rough, broken rock. Tracks are designed to oscillate freely even with the loader attachment. The bucket design permits digging in frozen stock piles, rough bottoms, heavy ores and in sticky clay or unbroken conglomerate.

Advantage: Eimcos are more maneuverable.

Reason: Eimcos use independent track control. Separate levers control each track and one track can be run forward while the other runs reverse.

Advantage: Eimcos last longer.

Reason: Torque converter drive is standard on Eimcos. All castings are alloy steel, all construction is extra heavy-duty.

Advantage: Eimcos load faster.

Reason: The overhead principle developed by Eimco is faster. Complete cycle is 10-12 seconds. Shifting from high to low on tractor or loader is done in motion. Shifting from forward to reverse can be done at full speed.

Other Advantages Include: Better visibility with the operator up front. Easier maintenance with clutches that never need adjustment and elimination of all clutches, brakes and gadgets in the final drive.

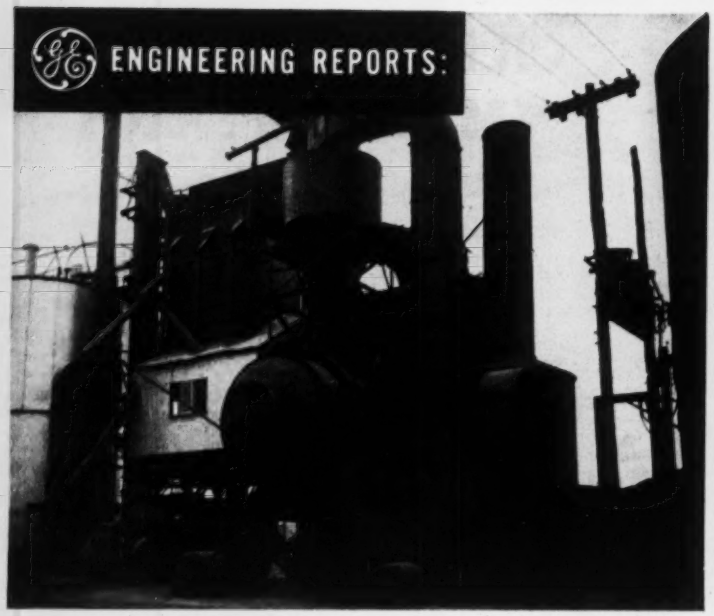
Let an Eimco engineer show you how you can cut loading costs on the next job.

Eimco 105 with bulldozer attachment

Eimco 105

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City
New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala.
Duluth, Minn. Kellogg, Ida. London, Eng. Paris, France Milan, Italy



G-E SERVICE is quickly available to any Simplicity-built plant. An asphalt plant must be dependable above all—no G-E motor has failed in this Triboro Asphalt Co., Flushing, N. Y., installation since its construction in 1949.

ECONOMICAL OPERATION is one advantage of using General Electric drives. This 100-hp G-E motor operates main dust blower at Triboro.

Large asphalt-plant builder standardizes on General Electric equipment for dependability

G-E motors and controls help maintain continuous high output at Simplicity-built plants

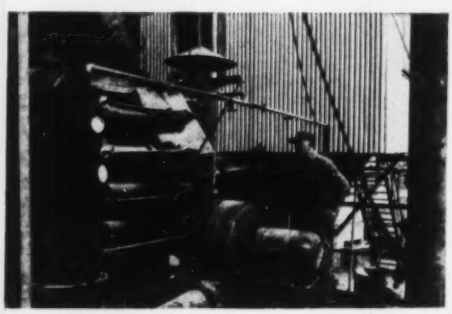
The Simplicity System Co. of Chattanooga, Tenn., has used General Electric motors and controls since they first electrified this type of asphalt plant. W. C. West, Simplicity general manager, says "We not only feel G-E apparatus is the most dependable of any available, but for years we've been highly pleased with G-E service."

Reliable, flexible motors are required for these applications. Simplicity-built plants are often remotely located at the end of utility lines or where power availability is low. Drive motors are subjected to very high starting torques. Even a one-hour shutdown can cost more than a thousand dollars in lost production alone. Because of these conditions, G-E motors designed to operate under high starting torques and low starting currents were selected after Simplicity ran a series of tests for various applications, in co-operation with G-E engineers.

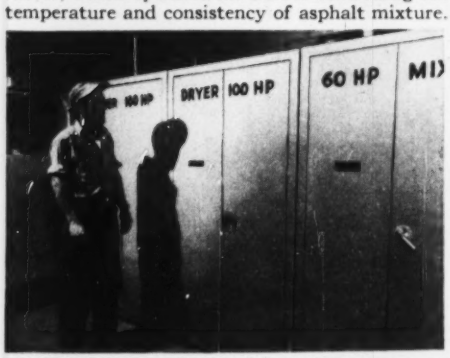
Your construction equipment will gain in dependability and efficiency too, when you electrify with G-E drives and power distribution equipment. They're backed by G-E engineering help in application, installation and service, available through any G-E Apparatus Sales Office, or by writing General Electric Co., Section 664-33, Schenectady, N. Y.

Engineered Electrical Systems for Heavy Construction

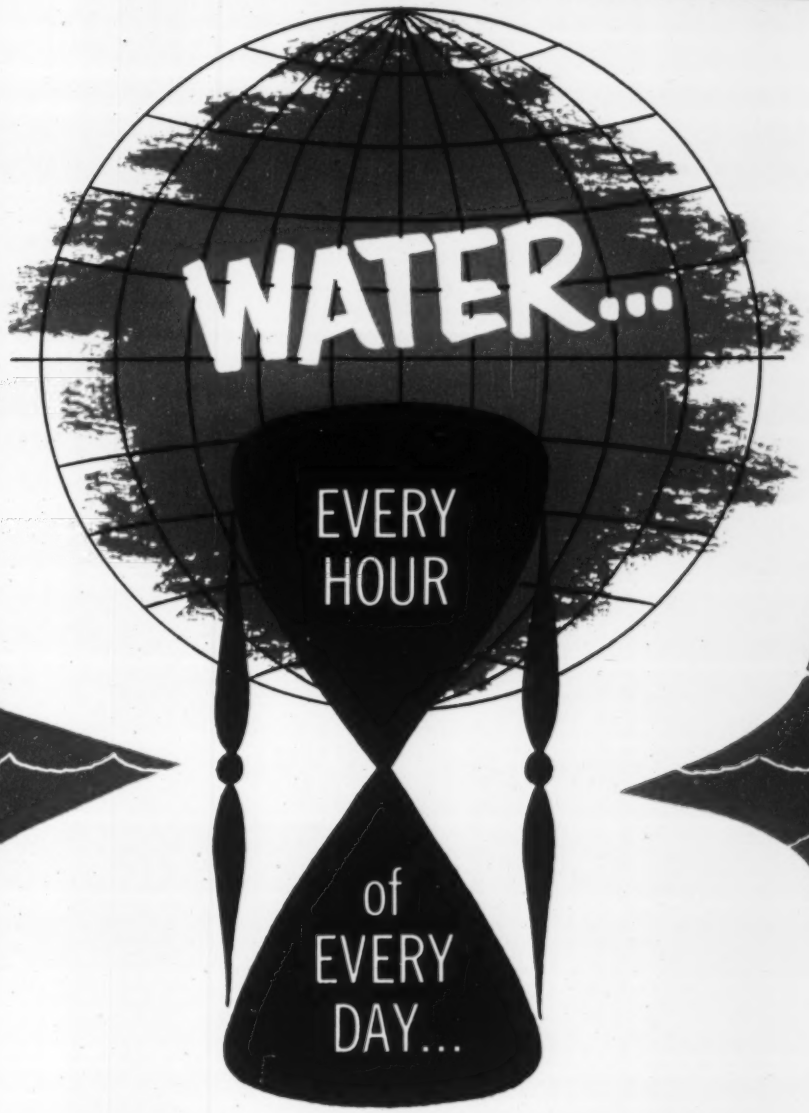
GENERAL ELECTRIC



DEPENDABILITY is built into this 25-hp G-E motor, which operates the burner controlling the temperature and consistency of asphalt mixture.



CENTRALIZED G-E CONTROL PANELS are factory assembled and system-wired; they provide safer control for all motors in a Simplicity plant.

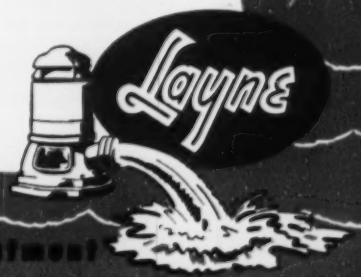


Every hour of every day of every month of every year more gallons of water are pumped by Layne pumps than there are people in the whole wide world. That world endorsement of Layne quality and Layne "know how" in developing ground water resources and in engineering water installations is the strongest possible reason for consulting Layne—first—on any question relating to water.

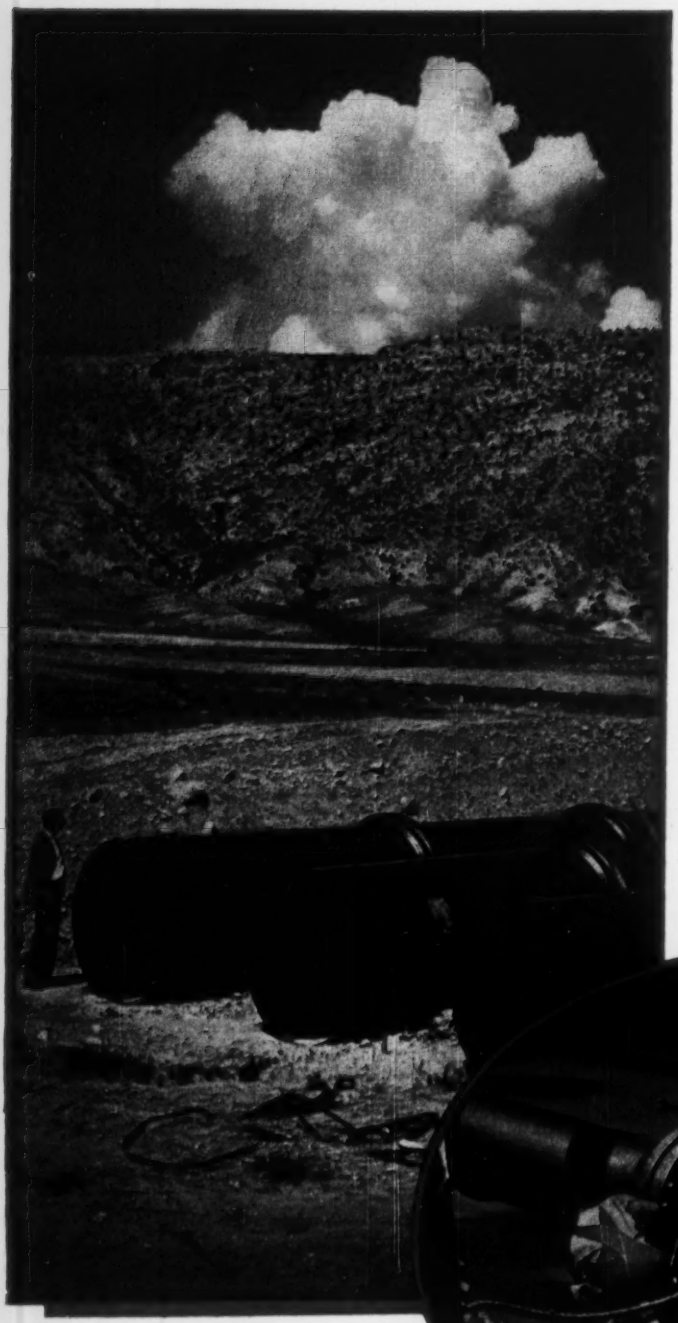
Layne Associate Companies Throughout The World

LAYNE & BOWLER, INC.

Memphis 8, Tennessee

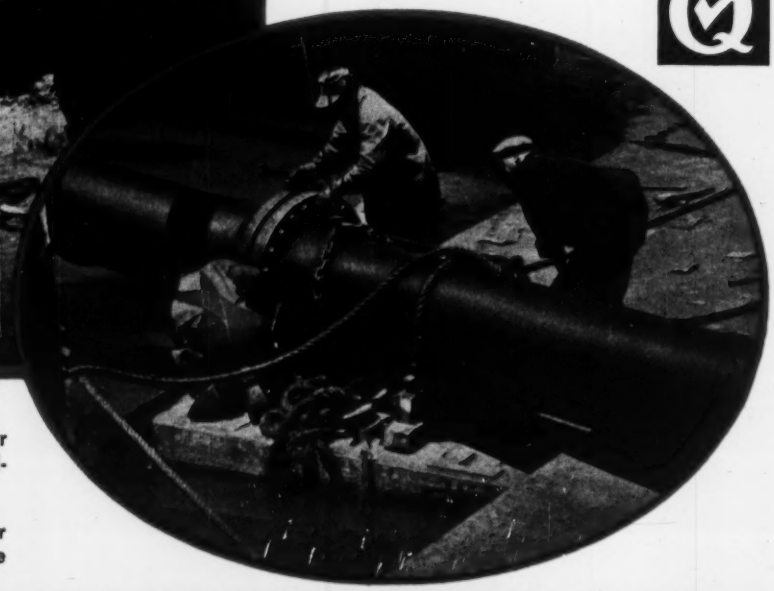


Water Wells • Vertical Turbine Pumps • Water Treatment



Versatile-

You know, of course, that cast iron pipe is widely used for water and gas mains, pressure sewers and outfalls, and almost exclusively in water filtration and sewage treatment plants. It is not so well known that this versatile pipe is also rendering yeoman service to Industry in keeping down maintenance cost in many applications. Such industries, for example, as chemical, paper, rayon and other process industries; coal mines and oil refineries; railroads and steel plants. Where effective resistance to corrosion is mandatory for long life and economy, specify cast iron pipe. For information write: Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3, Ill.

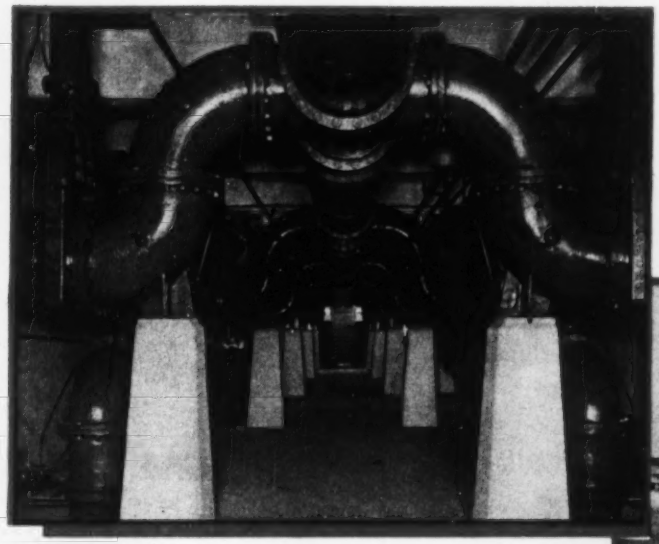


1800 feet of 36" to 60" cast iron pipe for culvert in connection with relocation of railroad tracks in Wyoming

(At right) A river-crossing cast iron water line near Chester, Pa., showing flexible joint assembly.

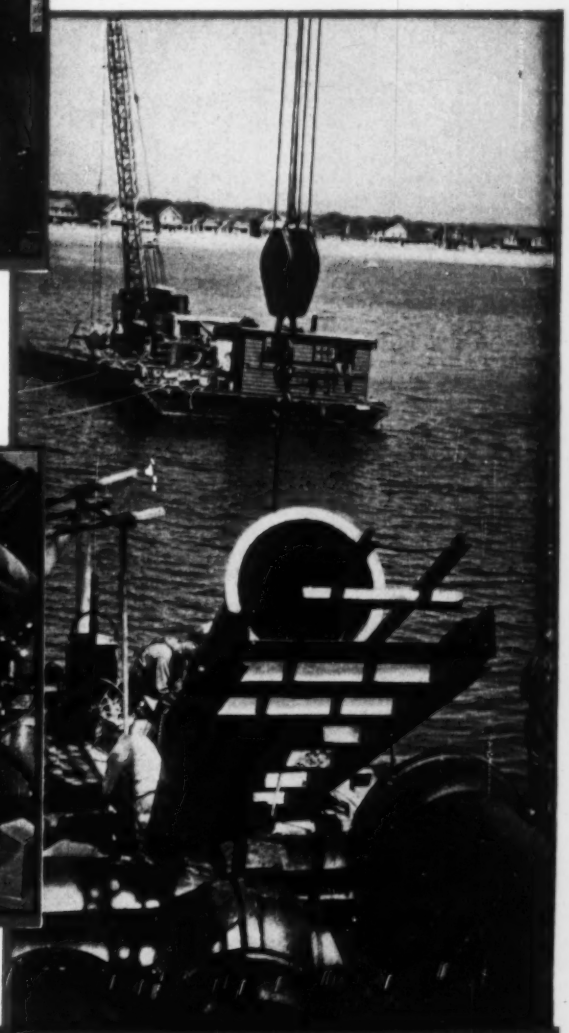
CAST IRON PIPE

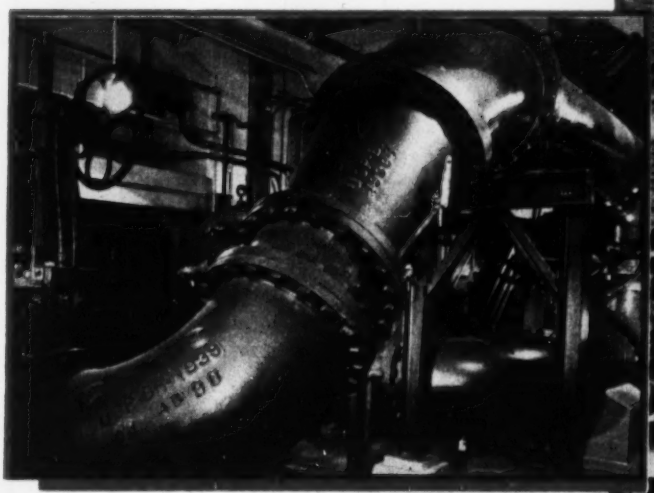
is the word for CAST IRON PIPE



Cast iron pipe and fittings installed in gallery of water filtration plant in Muskegon, Michigan.

Submarine installation of cast iron flexible joint pipe for outfall sewer into Long Island Sound at Fairfield, Conn.





Installation of cast iron pipe and fittings in steam plant of a gas and electric utility in California.

SERVES FOR CENTURIES...

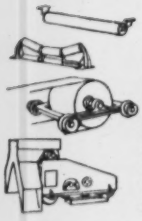
Carry the load via Link-Belt belt conveyors... SEE YOUR COSTS GO DOWN

LINK-BELT offers you the "total engineering" so necessary for top efficiency

DESIGNED FOR OVERALL EFFICIENCY

Because of its unrivalled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit conveyors into your overall system requirements.

BUILT FOR LONG-LIFE PERFORMANCE



Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the job.

DELIVERS FULL RATED CAPACITY

Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews if desired.

ASSURE SATISFACTORY PERFORMANCE

When you rely on Link-Belt as a single source for your complete system, Link-Belt accepts responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems.

This extensive belt conveyor system is another example of Link-Belt's preparedness to solve bulk handling problems, either large or small.

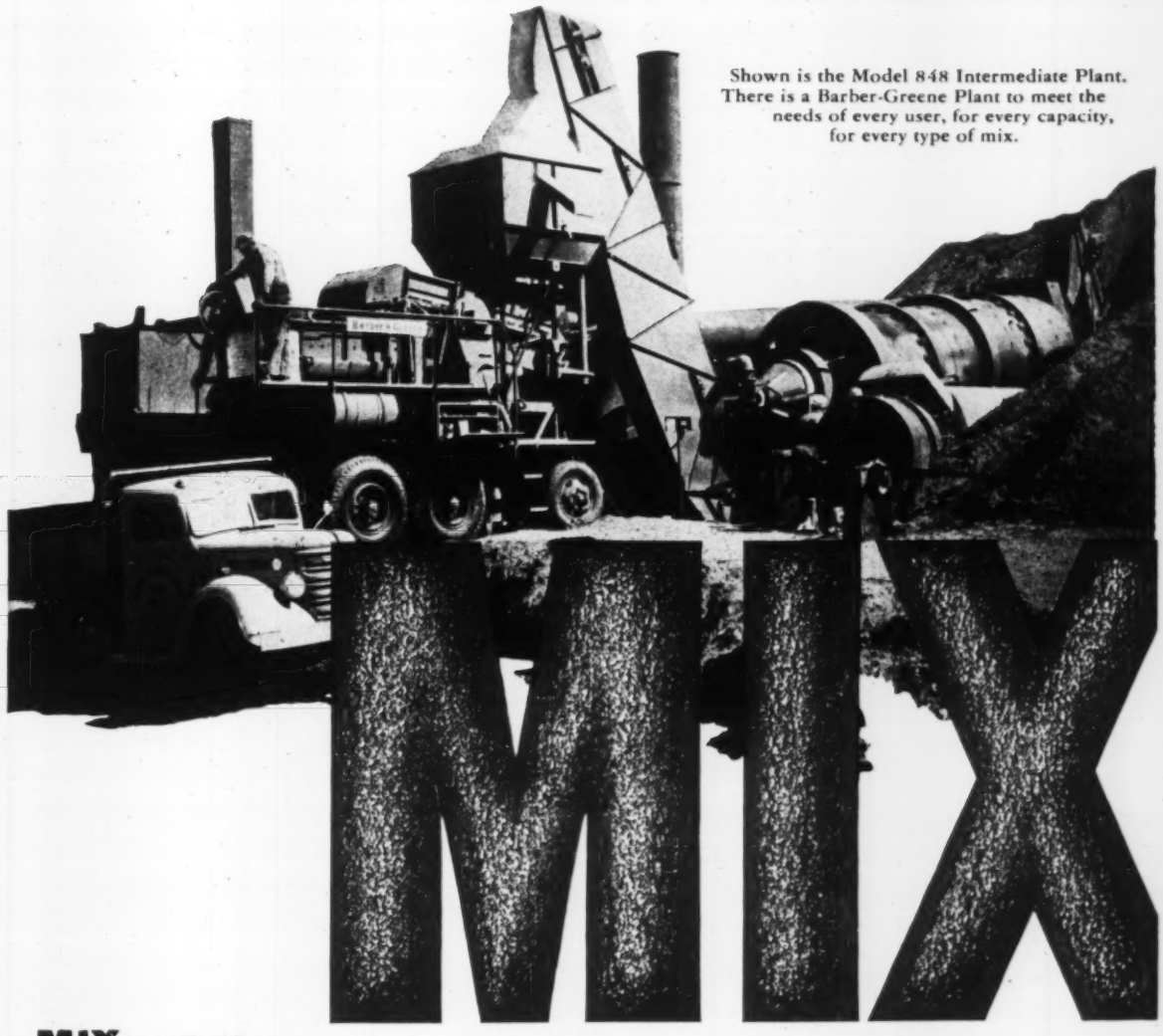
WHETHER it's a single belt conveyor or a complete system, there's no substitute for Link-Belt equipment and Link-Belt engineering. Call the district sales office near you for all the facts on this unique single-contract service.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13.467 B



Shown is the Model 848 Intermediate Plant. There is a Barber-Greene Plant to meet the needs of every user, for every capacity, for every type of mix.

MIX

MIX profitably.

MIX more tonnage per season. **MIX** to meet all specifications.

MIX continuously, with the principle that is inherently automatic.

MIX with mechanically interlocked proportioning for the utmost uniformity.

MIX with the plant that is truly portable.

Let us show you how a Barber-Greene Plant can reduce your costs.

54-39-B

Barber-Greene

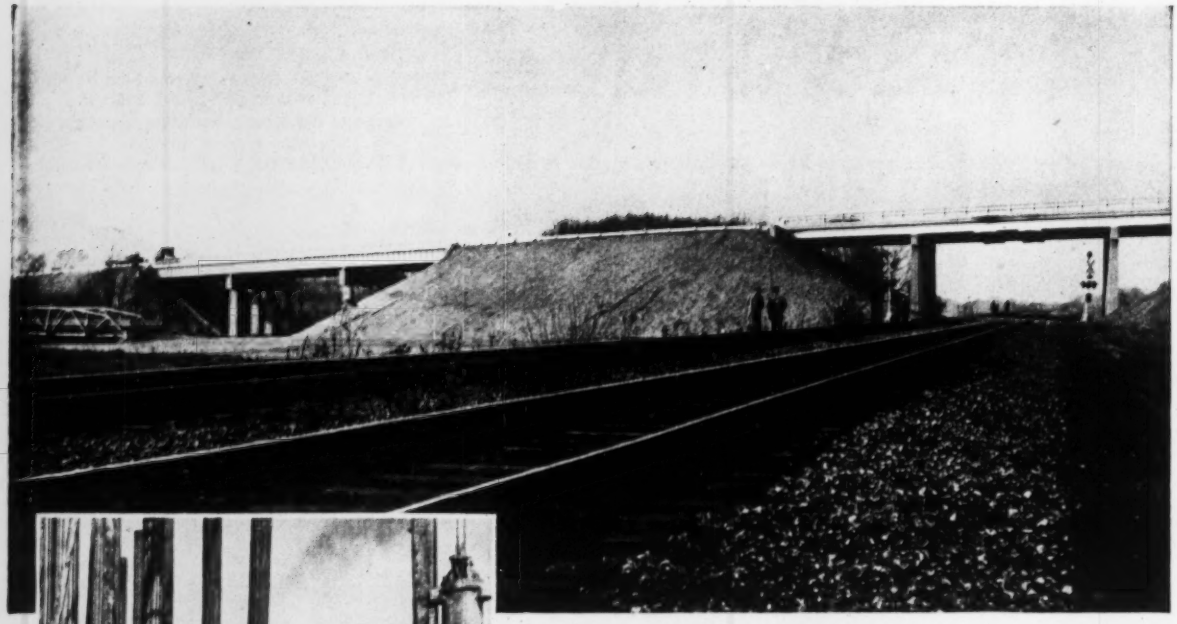
AURORA, ILLINOIS, U.S.A.

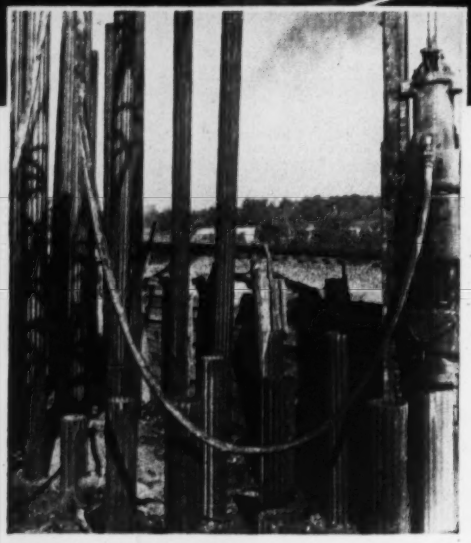
BG

WRITE for INFORMATION

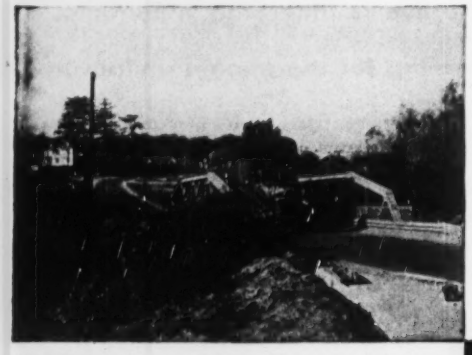
descriptive literature . . . sound movies

cost studies . . . nearby job inspection . . . plant layouts





Pile driving and extending under way for Ohio's two new Route 30 bridges (above) engineered by Bureau of Bridges, Ohio State Highway Dept. 286 eighty-foot Monotubes, with 8" tip and 12" butt diameter, were driven. General Contractor: The Lewis and Frisinger Co., Ann Arbor, Mich. Pile Driving Contractor: The Purdy Construction Company, Mansfield, Ohio.



Note the narrowness of this old bridge and the hazardous approach curve which have now been eliminated by Ohio's new Route 30 bridges.

MONOTUBES "go in" for faster, safer traffic and unmatched economy!

THESE new bridges at East Union, Ohio, on the heavily traveled Lincoln Highway, eliminate a triple threat . . . a small bottleneck bridge, a bad curve, and a hazardous railroad crossing. Both bridges are supported by rugged, cold-rolled Monotube foundation piles.

And speaking of eliminating threats, here's another case where Monotubes saved time and money by licking an unexpected problem. The piles had to go much deeper than anticipated, but due to Monotubes' simple field extendibility, the required penetrations were readily achieved using the same light crawler crane with which the job was started—no penalty for heavier equipment.

You stand to gain many other advantages with Monotube piles. Write to The Union Metal Manufacturing Co., Canton 5, Ohio, for Catalog No. 81.

UNION METAL

Monotube Foundation Piles

MULTI-PURPOSE LOADERS SAVE MONEY

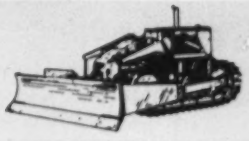
Examples of many uses for Eimco 105 Tractors with excavating attachments are sent in by Eimco's field engineers. The customer buys his Eimco for loading but usually finds that it also performs many additional jobs that make the 105 pay for itself quickly in bonus work.

The picture above shows an Eimco high discharge excavator attachment on an Eimco 105 Tractor loading into an ore bin. The owner decided he could save time by cutting a new road into his pit and found the 105 could cut its own road.

Many other Eimco 105 owners are finding them ideal for ripping up old curbs and paving, tearing out old foundations, digging ditches, basements, patching highways and many other jobs in the heat of the desert or the cold of the Yukon — Eimcos are tops on any job anywhere.

Write for more information.

Eimco 105



Eimco 105 with bulldozer attachment

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. London, Eng. Paris, France Milan, Italy

9-84

Another Reason for Specifying COBI PILES

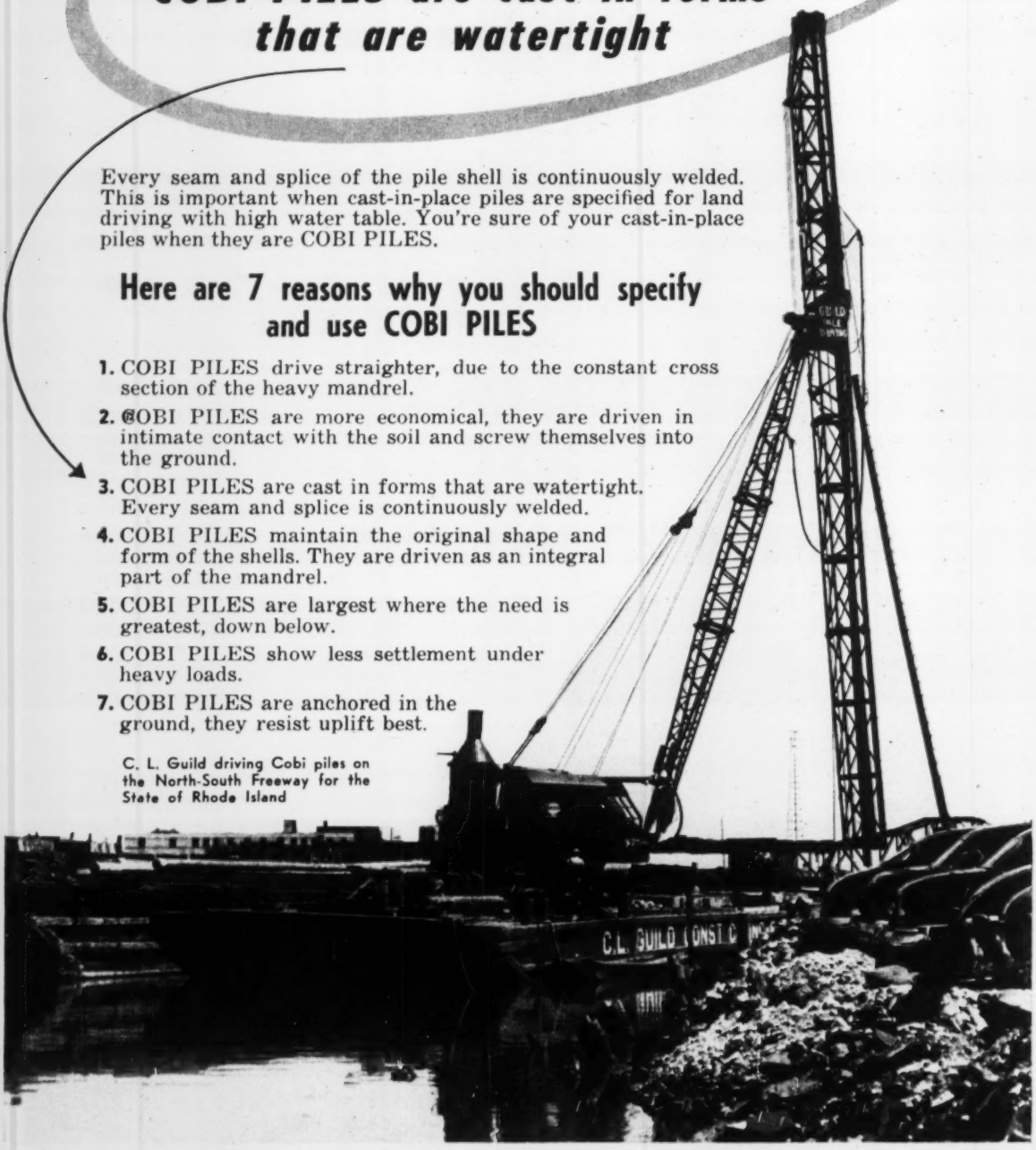
COBI PILES are cast in forms that are watertight

Every seam and splice of the pile shell is continuously welded. This is important when cast-in-place piles are specified for land driving with high water table. You're sure of your cast-in-place piles when they are COBI PILES.

Here are 7 reasons why you should specify and use COBI PILES

1. COBI PILES drive straighter, due to the constant cross section of the heavy mandrel.
2. COBI PILES are more economical, they are driven in intimate contact with the soil and screw themselves into the ground.
3. COBI PILES are cast in forms that are watertight. Every seam and splice is continuously welded.
4. COBI PILES maintain the original shape and form of the shells. They are driven as an integral part of the mandrel.
5. COBI PILES are largest where the need is greatest, down below.
6. COBI PILES show less settlement under heavy loads.
7. COBI PILES are anchored in the ground, they resist uplift best.

C. L. Guild driving Cobi piles on the North-South Freeway for the State of Rhode Island



C. L. GUILD CONSTRUCTION CO., INC.
94 Water Street — *East Providence, Rhode Island*

EASTERN CONCRETE PILE CO.
80 Boylston St., Boston, Mass.

DIVISIONS

AMERICAN DRILLING COMPANY
92 Water St., E. Providence, R. I.

Horton Elevated Tank for Miami . . .

In this age of record population growth, an increasing number of municipal water systems are finding it difficult to keep abreast of customers' demands. Both careful planning and action are required to keep facilities up-to-date and service satisfactory.

Miami, Florida, recently installed this 1,000,000-gal. Horton® radial-cone elevated tank at 76th Street to improve their distribution system. Perhaps a Horton elevated tank can assist your community in solving the problems of water storage, maintaining uniform pressure, and lowering pumping costs. Frequently, insurance ratings are more favorable for a community because of the increased fire protection that only an adequate water supply can provide.

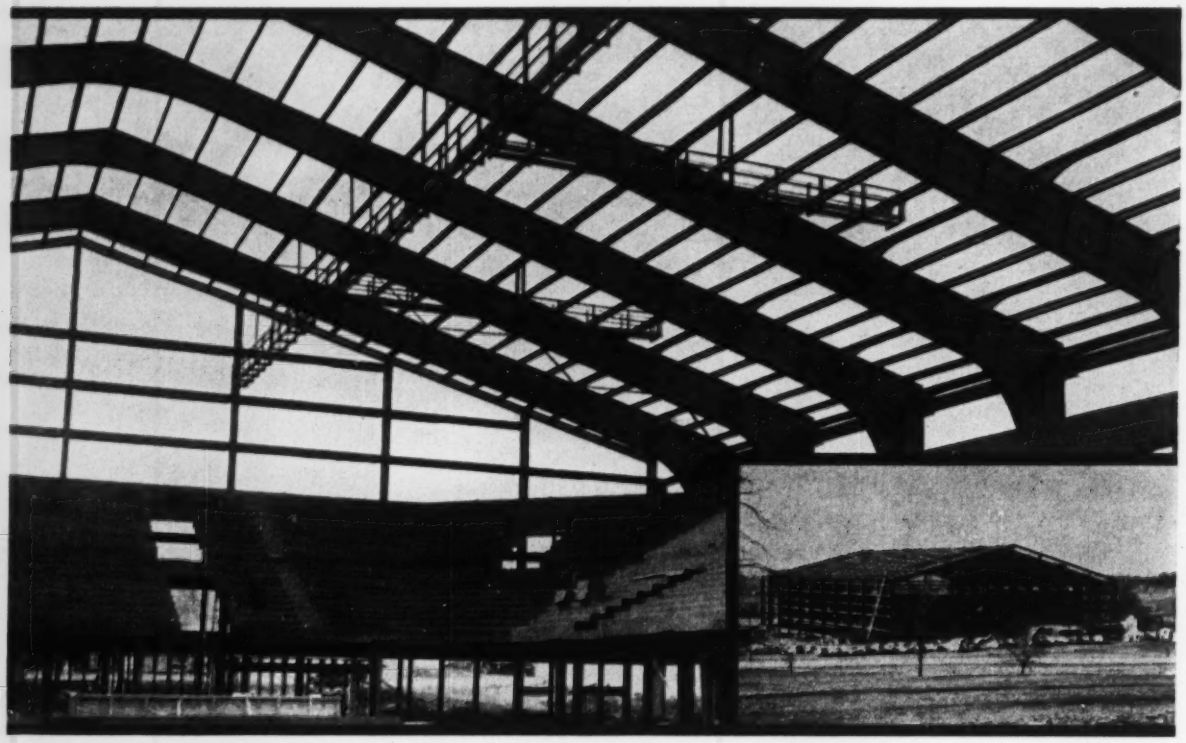
• • • •

Periodic inspection and painting normally suffice to keep a welded steel Horton elevated tank in excellent condition. Standard capacities are available from 15,000 to 3,000,000 gallons. Our nearest office will welcome your request for information or quotations without obligation.

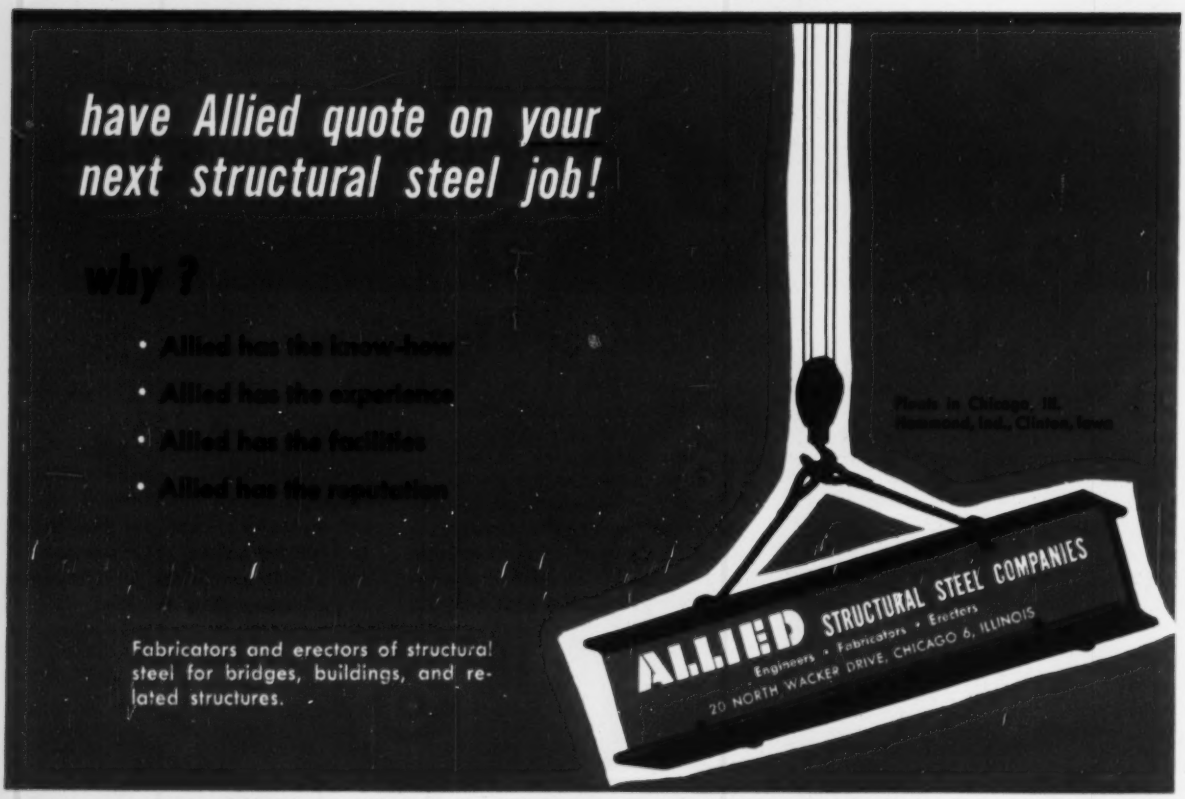
CHICAGO BRIDGE & IRON COMPANY

Atlanta 3.....2167 Healey Bldg.
Birmingham 1.....1596 N. Fiftieth St.
Boston 10.....1009—201 Devonshire St.
Chicago 4.....2199 McCormick Bldg.
Cleveland 15.....2263 Midland Bldg.
Detroit 26.....1541 Lafayette Bldg.
Houston 2.....2128 C & I Life Bldg.
Los Angeles 17..1556 Gen. Petroleum Bldg.
New York 6.....3395—165 Broadway Bldg.
Philadelphia 3..1652—1700 Walnut St. Bldg.
Pittsburgh 19.....3210 Alcoa Bldg.
Salt Lake City 4....509 West 17 South St.
San Francisco 4.....1584—200 Bush St.
Seattle 1.....1309 Henry Bldg.
Tulsa 3.....1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.



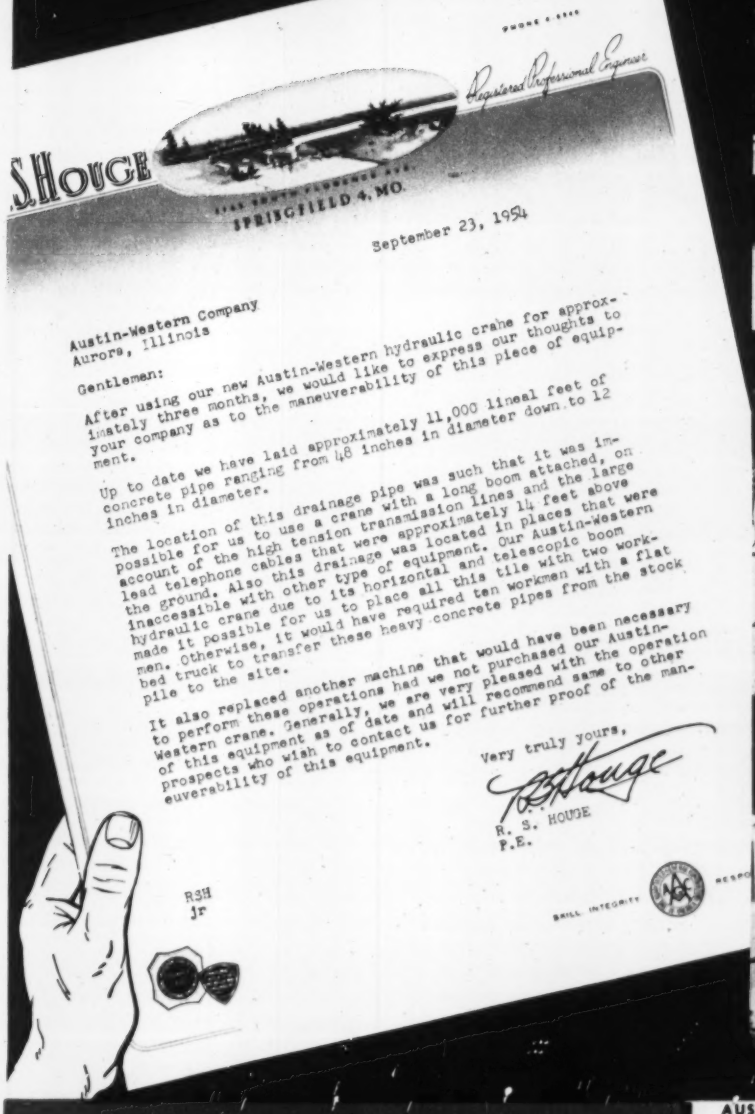
UNIVERSITY OF KANSAS BUILDS NEW FIELD HOUSE: More than 2,700 tons of structural steel went into the framework of new field house at the University of Kansas, Lawrence, Kansas. The structure features 10 rigid frames which provide a clear span of 250 feet. The frames, which weigh 80 tons each, are completely welded, and were produced simultaneously in Allied's three plants at Chicago, Illinois, Hammond, Indiana, and Clinton, Iowa. The three plants worked on a schedule that permitted shipments to be made in a prearranged sequence (about 10 days apart), with frames arriving in Lawrence, Kansas, as needed by erection crews. The new building, completed in March, 1954, is used as an armory and for physical education purposes. It has a seating capacity of 15,490 people.


have Allied quote on your next structural steel job!
why ?
• Allied has the know-how
• Allied has the experience
• Allied has the facilities
• Allied has the reputation
Fabricators and erectors of structural steel for bridges, buildings, and related structures.
Plants in Chicago, Ill., Hammond, Ind., Clinton, Iowa
ALLIED STRUCTURAL STEEL COMPANIES
Engineers • Fabricators • Erectors
20 NORTH WACKER DRIVE, CHICAGO 6, ILLINOIS

Send your plans and specifications to Allied Structural Steel Companies, Suite 1773, 20 North Wacker Drive, Chicago 6, Illinois

TAKE IT FROM A MAN WHO KNOWS

HERE'S A MISSOURI CONTRACTOR WHO SAYS...



R. S. HOUSE
Registered Professional Engineer
SPRINGFIELD 4, MO.

September 23, 1954

Austin-Western Company
Aurora, Illinois

Gentlemen:

After using our new Austin-Western hydraulic crane for approximately three months, we would like to express our thoughts to your company as to the maneuverability of this piece of equipment.

Up to date we have laid approximately 11,000 lineal feet of concrete pipe ranging from 48 inches in diameter down to 12 inches in diameter.

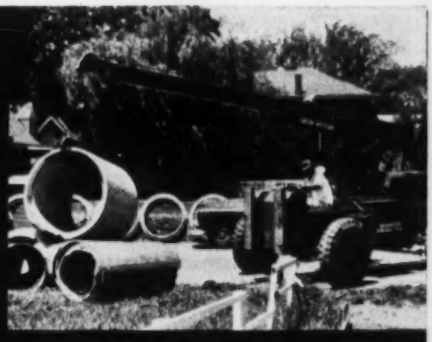
The location of this drainage pipe was such that it was impossible for us to use a crane with a long boom attached, on account of the high tension transmission lines and the large lead telephone cables that were approximately 14 feet above the ground. Also this drainage was located in places that were inaccessible with other type of equipment. Our Austin-Western hydraulic crane due to its horizontal and telescopic boom made it possible for us to place all this tile with two workmen. Otherwise, it would have required ten workmen with a flat bed truck to transfer these heavy concrete pipes from the stock pile to the site.

It also replaced another machine that would have been necessary to perform these operations had we not purchased our Austin-Western crane. Generally, we are very pleased with the operation of this equipment as of date and will recommend same to other prospects who wish to contact us for further proof of the maneuverability of this equipment.

Very truly yours,

R. S. HOUSE
P.E.

RSH
jr



LIFTING

CARRYING

LOWERING

SPOTTING

AUSTIN-WESTERN COMPANY
Construction Equipment Division • Baldwin-Lima-Hamilton Corporation
AURORA, ILLINOIS, U.S.A.
Power Graders • Motor Sweepers
Road Rollers • Hydraulic Cranes

AUSTIN-WESTERN COMPANY
628 Farnsworth Avenue, Aurora, Illinois

Please send complete information and literature on the Austin-Western Hydraulic Crane.

Name .....
Title .....
Company .....
Street .....
City ..... Zone ..... State .....

NEWS OF ENGINEERS

Charles E. Schaffner has been promoted to the position of assistant administrative dean of the Polytechnic Institute of Brooklyn. Dean Schaffner has been a member of the faculty since 1946 and director of the evening session since 1951, in addition to being in charge of surveying and the highway materials testing laboratory.

Warren Coolidge, public works director of Nashville, Tenn., has been elected president of the American Public Works Association for 1954–1955. Mr. Coolidge has been vice-president of APWA for the past four years.

Robert L. Hahn, consulting engineer of Spokane, Wash., announces the opening of an office at W. 404 Boone for the practice of civil, industrial, and structural engineering with emphasis on grain handling, processing and storage plants. In recent years Mr. Hahn has been associated with the Jones-Hettelsater Construction Co., Kansas City, Mo., and E. R. Haynes, of Spokane, as chief engineer.

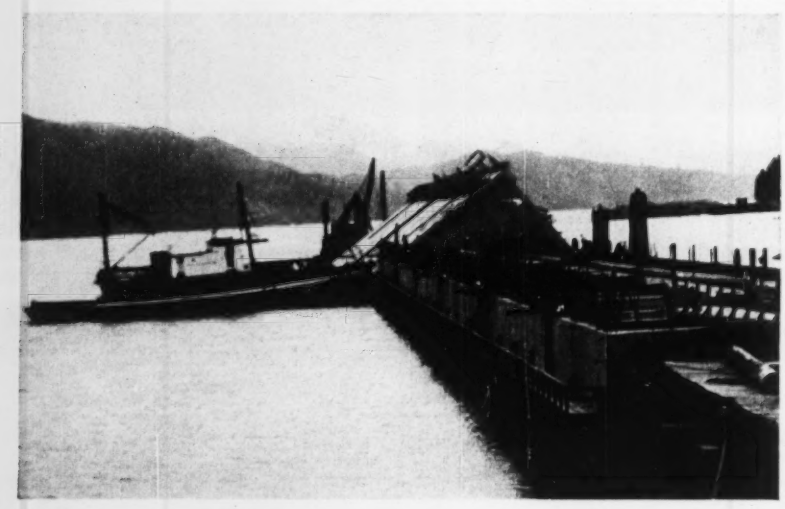
Louis J. Goodman, assistant professor of civil engineering at Lehigh University, is now serving in a similar capacity at Syracuse University. Professor Goodman's duties include development of the soils mechanics and transportation programs.

Thomas J. Seburn is retiring as city traffic director for Kansas City, Mo., after 24 years in that capacity. Mr. Seburn has joined the Yale University Bureau of Highway Traffic as a research associate. He will be succeeded by **Jack A. Hutter,** a member of the traffic department since 1948.

Simon Ince has been appointed assistant professor of civil engineering in the Rutgers University College of Engineering. Dr. Ince was an instructor at the University of Iowa from 1947 to 1953, and prior to that, research assistant and associate at the Iowa Institute of Hydraulic Research.

John S. Flockhart, chief engineer of the Newark, N.J. Department of Public Works, was recently appointed to the new post of city administrator. Mr. Flockhart has been in municipal service for more than 33 years.

Kenneth Brunner has been appointed chief construction engineer for J. S. Hamel and A. A. Dorman, Los Angeles, Calif. Mr. Brunner, until recently a design engineer with Koebig and Koebig of Los Angeles, is working on the Disneyland project located south of Anaheim.



"They tilted 30,000 tons of concrete..."

This unique ore-loading wharf designed in Plastiment-concrete by Frederic R. Harris, Inc., Consulting Engineers of New York, for the Aluminum Company of Canada's gigantic Kitimat project, was cast on its side, floated into place and tilted 90° into final position.

Floating Plastiment-concrete structures are not new. . . . Of the seven American projects featured as Famous Floating Concrete Structures in the May issue of the Journal of the American Concrete Institute, five were constructed of Plastiment-concrete . . . most of the foreign jobs shown also contained Plastiment, supplied from the fourteen overseas Sika manufacturing organizations.

While you may not be designing a floating concrete pier, the special qualities that made this concrete denser, more uniform, and more resistant to cracking and abrasion are undoubtedly a must in your own construction projects. Performance has proven that Plastiment can help you attain this goal.

For the story on the Kitimat project, plus a detailed explanation of Plastiment's exclusive action on cement gels, write for your copy of Sika Job 14 and the illustrated brochure "PLASTIMENT CONCRETE DENSIFIER." Our Engineering Department will be glad to tell you how Plastiment can help you on your present job.

Sika

PLASTIMENT CONCRETE DENSIFIER

SIKA Chemical Corporation, Passaic, New Jersey

Branch Offices: Pittsburgh, Salt Lake City, Montreal, Chicago, Panama • Dealers in Principal Cities

Newly-elected ASCE Honorary Member Shortridge Hardesty is shown cutting a birthday cake at a surprise office party given by his employees to mark his seventieth birthday. Mr. Hardesty, senior partner in the New York consulting firm of Hardesty & Hanover, was also presented with a gold watch.

Herman L. Nelson, assistant highway director of the Alabama State Highway Department, was recently made state highway director. He has been in the department for 28 years.

Laurence S. Hensley has resigned as assistant professor of civil engineering at North Carolina State College to enter private practice at Durham, N.C.

Paul L. Holland, Baltimore director of public works since 1949, resigned his post on October 1 to accept the position of regional manager for the John McShain, Inc., with headquarters in Baltimore. He will head operations throughout Maryland and adjoining states. Mr. Holland served as an ASCE Director from 1949 to 1951. Designated acting director of the Department of Public Works is Deputy Director **George A. Carter.**

Paul L. Holland

John M. Adams, who has been with the Lehigh Coal and Navigation Company since 1945, was recently promoted from first assistant engineer to corporate engineer and real estate agent.

George R. Thompson, who recently retired as city engineer of Detroit, Mich., after 17 years in the post, has been appointed to the executive staff of Giffels & Vallet, Inc., L. Rossetti, associated engineers and architects of Detroit.

Paul F. Rice, for the past five years structural field engineer for the Michigan District of the Portland Cement Association, has been named technical director for the American Concrete Institute at Detroit.

Earl I. Brown, II, formerly associate professor of civil engineering at Georgia Institute of Technology, was recently named head professor of civil engineering at Alabama Polytechnic Institute.

Clinton L. Bogert, Fred S. Childs, Ivan L. Bogert, Donald M. Ditmars, Robert A. Lincoln, Charles A. Manganaro and **William Martin,** are partners in the new consulting firm of Bogert and Childs, formed as a result of the consolidation of Bogert-Childs Engineering Associates and Clinton L. Bogert Associates. The business of the new firm will continue to be conducted at 624 Madison Avenue, New York, N. Y., and 173 Main St., Hackensack, N. J.

George J. Kral, of Cincinnati, Ohio, has been appointed an associate engineer with the firm of Harry Balke Engineers, of that city. Formerly with the Ferro Concrete Construction Company, Mr. Kral was project engineer for the Cincinnati Milling Machine Co. on its recently completed engineering and research building. He is currently vice-president of the Cincinnati Section.

E. A. Moritz, of Boulder City, Nev., who retired after 40 years with the Bureau of Reclamation, has been named to membership on the Colorado River Commission.

George H. Hickox has been appointed program director for engineering sciences in the Mathematical, Physical and Engineering Sciences Division of the National Science Foundation, Washington, D. C. Dr. Hickox has been associate director of the Engineering Experiment Station of the University of Tennessee since 1948. He is the recipient of numerous awards for his engineering research including the Society's James Laurie Prize in 1949.

H. B. Funderburk has been transferred from the Chicago Bridge & Iron Company's Birmingham (Ala.) plant to the Houston sales office.

H. B. Wildschut, city engineer and director of public service for Wauwatosa, Wis., since 1946, has been appointed Milwaukee County's first expressway engineer to handle all expressway planning and construction for the area.

(*Continued on page 24*)

126,000 Square Ft.
...spanned with
LACLEDE STEEL JOISTS

Framing large areas presents no problem with these lightweight, open-web joists. Here, for example, is the 126,000-square-foot Service Building for Scruggs-Vandervoort-Barney, one of St. Louis' leading department stores. Scheduled for completion in early fall, this is one of many buildings throughout the nation erected with Laclede Straight Chord Steel Joists—the choice of more and more contractors for fast, economical construction.

OTHER LACLEDE PRODUCTS

Multi-Rib Reinforcing Bars • Steel Pipe • Welded Wire Fabric
Form and Tie Wire • Spirals • Conduit • Corrugated Steel
Centering • Electrical Weld and Gas Weld Tubing

LACLEDE STEEL COMPANY
St. Louis, Mo.

News of Engineers

(*Continued from page 23*)

Robert C. Dennett, engineering consultant for the National Board of Fire Underwriters, was honored at a dinner in the Hotel Commodore, New York, on October 1, marking his retirement after 50 years of continuous service. Mr. Dennett has been field engineer, office engineer, and assistant chief engineer of the organization.

William H. Latham, consulting park engineer for the New York City Department of Parks, was recently named resident engineer in charge of construction for the St. Lawrence power project. He will be located at a new field office in the Massena (N.Y.) area.

Frank Kerekes, assistant dean of engineering and professor of civil engineering at Iowa State College, has been named dean of the academic program at Michigan College of Mining and Technology, Houghton, Mich. A member of the Iowa State faculty for 34 years, Professor Kerekes has been assistant dean since 1947. He has also acted as consulting structural engineer to a number of architectural and industrial organizations.

Frank Kerekes

Kirk H. Stealy has been promoted from chief office engineer to associate engineer in the firm of Benham Engineering Co., Oklahoma City, Okla. Other members of the staff promoted to the same rank are **Allen G. Poppino,** structural engineer, and **T. B. Shoebotham,** sanitary and power engineer.

Robert F. Herdman retired from the Bureau of Reclamation on August 31 after 24 years of service. For the past two years Mr. Herdman has been project engineer at Beirut, Lebanon, directing a staff of 21 Americans on a technical-assistance program to develop uses of the Litani River.

Lawrence Adams, consulting engineer of Modesto, Calif., and his associate, **Fred M. Johnson,** announce the relocation of their offices in the Taylor Building, 1014A Twelfth St., Modesto. The firm will continue to engage in a general civil engineering and land surveying practice.

William R. Seeger was recently promoted from assistant general manager and assistant chief engineer to general manager and chief engineer of the Marin Municipal Water District, San Rafael, Calif.

Richard L. Steiner, director of the Baltimore Redevelopment Commission, has joined the U.S. Housing and Home Finance Agency as deputy chief of slum clearance and urban development.

Michael Baker, Jr., president of Michael Baker, Jr., Inc., Rochester, Pa., has been elected a member of the national Young Presidents' Organization—a group comprised of men under 39 who have reached the presidency of companies in the United States doing $1,000,000 business annually.

William Fitzhugh Turner retired from active service with the Southern Pacific Co. on June 30. Associated with the railroad line since 1906, he has been division engineer of the Sacramento Division for the past 31 years. Following his retirement Mr. Turner was appointed engineering consultant by the federal government on the government-owned and operated Alaska Railroad.

J. E. Wheeler has been promoted from project engineer to manager of erection for the Fort Pitt Bridge Works, Pittsburgh, Pa., effective October 1.

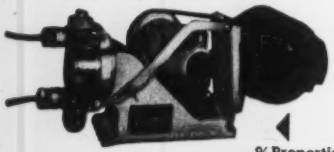
Russell L. Culp, chief of the Water Supply Section of the Kansas State Board of Health, has been designated technical secretary of the newly-created Kansas Water Resources Fact Finding and Resources Committee. Mr. Culp, whose office will be in Lindley Hall on the University of Kansas campus, will review critically the current status of the state's water supplies.

Nikhileswar Sanyal, professor of civil and sanitary engineering at the Government Engineering College, Jabalpur, India,

May we help?

Solving water problems is our business. Our engineering files contain over 40,000 case histories cross-indexed for easy reference. Whatever your problem — whether it involves sterilization, coagulation, pH control, taste and odor control, or water filtration %Proportioneers% has the experience and equipment "in stock" to solve it.

%Proportioneers% Model 47 Chem-O-Feeder — for hypochlorite, alum, soda ash, lime, ferric sulphate.



%Proportioneers% world famous "Little Red Pump" — the Heavy Duty Midget Chlor-O-Feeder. Simple, adaptable, dependable. Recommended for a wide range of water treating applications.

May we help? Send for data and recommendations to Proportioneers, Inc., 360 Harris Ave., Providence 1, R. I.

% PROPORTIONEERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.

BIF METERS FEEDERS CONTROLS

EVERYONE IS PLEASED WITH THEIR *Flexible* SEWERODER AT WILLIAMSPORT, PA.

Taxpayers and workers alike are complimenting the Williamsport Sanitary Authority for having had the good judgment to buy a "Flexible" SeweRodeR. This is the mechanical rodding marvel that eliminates 9/10th of the usual hard labor in a day's work. It will clean 50 blocks of sewers per week at a cost of less than 3c a foot including labor, maintenance and parts replacement.

Recently Williamsport had a 2.9 inch rainfall which caused the sewers to stop up. The SeweRodeR did the "opening" job so fast the citizens are saying, "Now we are getting some real service!" The Authority found the sewers filled up with roots—indicating that in the past the lines had merely been opened—not cleaned.

Pointing to the machine is Mr. Kenneth Glenz, mgr. of the Authority. Standing next is Frank Heller, Sect'y. The fine crew, left to right, is Walter Kuna, Foreman, Lawrence Gephart, operator and Victor Andy.

FREE DEMONSTRATION INVITED

Write for our **FREE** *Catalog*

Flexible **SALES CORPORATION**

3786 Durango Ave., Los Angeles 34, Calif.

(DISTRIBUTORS IN PRINCIPAL CITIES)

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT

has received the degree of master of science in engineering from Johns Hopkins University.

Gordon W. Dabney, of San Antonio, Tex., will be with the Foreign Operations Administration at La Paz, Bolivia, for the next two years as a highway engineer. Previously Mr. Dabney was employed as an engineer in the roads and railroad branch of Engineering Section Headquarters of the Fourth Army, at Fort Sam Houston, Tex.

Herbert Hoover, former president of the United States and an Honorary Member of ASCE, was named a fellow of the Standards Engineers Society at its third annual meeting in Atlantic City, N.J. The award, which is the society's highest honor, was given for the first time this year.

Edward Sampson, Jr., and **Walter A. Weers** have been appointed assistant professors of civil engineering at the University of Colorado. Professor Sampson previously taught at Colorado College and Professor Weers at North Dakota Agricultural College.

Lockwood J. Towne, former vice-president and construction manager for the Stone & Webster Engineering Corp., in New York, N.Y., is now engaged as chief consultant on the newly created Real Property Task Force of the Commission on Organization of the Federal Branch of the Government.

Charles E. Trout has retired from active duties as vice-president and manager of the Atlantic Division of the Great Lakes Dredge & Dock Co., in New York, after many years of service. Active in Society affairs, Mr. Trout has been serving as treasurer since 1941. He was Director from 1934 to 1936.

Charles E. Trout

Lawrence J. Lincoln, Colonel, U. S. Army, recently graduated from the Army War College, Carlisle Barracks, Pa., and has assumed the duties of Army Engineer at Fourth Army headquarters, San Antonio, Tex. In his new assignment Colonel Lincoln will be senior staff engineer for Lt. Gen. I. D. White, commanding general of the Fourth Army.

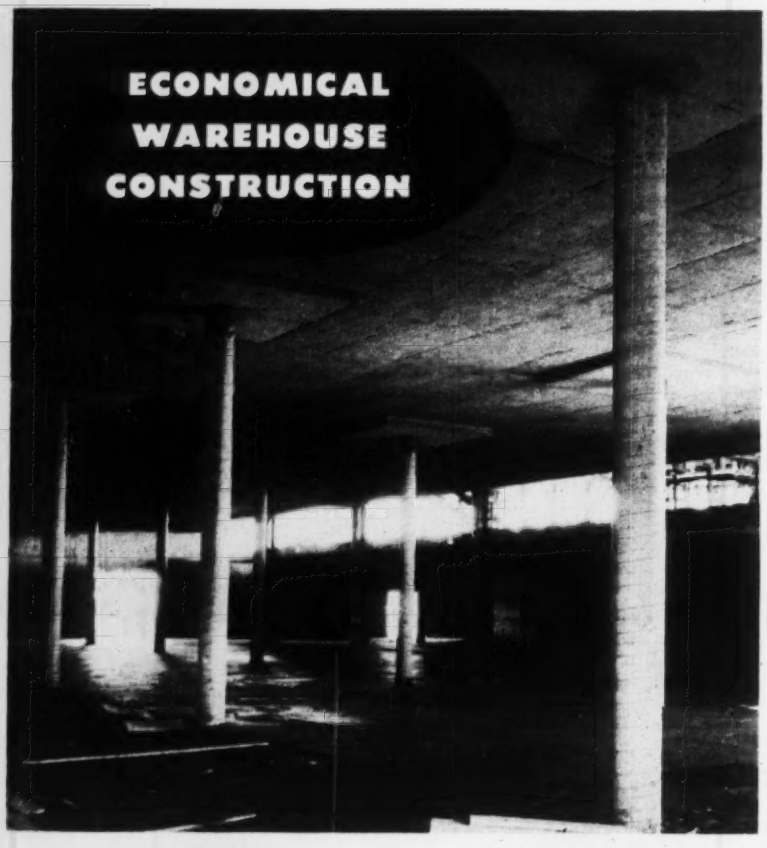
Lewis A. Dickerson, in conjunction with Sargent, Webster, Crenshaw & Folley, of Watertown, N.Y., has become a partner in a new organization—Sargent, Webster, Crenshaw & Folley, Architect-Engineer Associates—with offices in Watertown and Massena, N.Y. The firm is engaged in a practice of general civil engineering, aerial and ground surveys and land planning. Mr. Dickerson was formerly a consultant for Lockwood, Kessler and Bartlett, Inc., at Great Neck, N.Y.

Wellington Donaldson, deputy director of the New York City Division of Sewage Disposal, retired on August 1, after twenty years of municipal service.

Carl Vernon Youngquist, chief of the Division of Water, in the Ohio State Department of Natural Resources, Columbus, has been appointed consultant staff director of the Cabinet Committee on Water Resources Policy.

Joseph F. Jelley, Jr., CEC, USN, former Director of Construction in the Department of Defense, will assume duty as director of the Pacific Division of the Bureau of Yards and Docks and officer-in-charge of the Tenth Naval Construction Brigade, with headquarters at Pearl Harbor. Admiral Jelley has served as deputy, assistant chief, and chief of the Bureau of Yards and Docks.

(*Continued on page 26*)



Southern Rwy. warehouse, Jacksonville, Fla.
Wesley and Co., Contractors and Engineers

Sonotube®

FIBRE FORMS

for round columns of concrete

The round concrete columns for this warehouse were formed with low cost SONOTUBES of 13.5″ I.D. 17′ in height.

Whatever the structure, for a fast, economical method of forming round columns of concrete, use SONOTUBE Fibre Forms and save time, money and labor!

SONOTUBES are lightweight and easy to handle . . . require minimum bracing. Approved by architects and engineers, widely used by contractors everywhere.

In 31 sizes, from 1″ to 36″ I.D. up to 50′ long. Can be ordered in specified lengths or sawed to your requirements on the job.

DENFORM reusable capital form designed for use with SONOTUBES. Write for details.

See our catalog in Sweet's
For complete technical data and prices, write

SONOCO PRODUCTS COMPANY
Construction Products Division
LOS ANGELES, CAL. — HARTSVILLE, S. C. — MAIN PLANT — MONTCLAIR, N. J.
AKRON, IND. — BRANTFORD, ONT.

sonoco
"AROUND THE WORLD"
A PAPER CARRIER
REG. U.S. PAT. OFF.

News of Engineers

(*Continued from page 25*)

H. George Gerdes, who was recently appointed power engineer for Kaiser Engineers Division of the Henry J. Kaiser Co., Oakland, Calif., has been assigned to the firm's hydroelectric power development program. Before joining the company Colonel Gerdes (USA, retired) had a consulting practice at Colorado Springs, Colo.

Edmund B. Besselievre became manager of the newly-created industrial wastes division of Kaighin & Hughes, Inc., industrial engineering firm of Toledo, Ohio, on November 1. Formerly chief sanitary engineer of the international division of the Dorr Company, Stamford, Conn., Mr. Besselievre has handled sanitary engineering projects in 63 countries over a period of 30 years. He is the author of *Industrial Waste Treatment* published by McGraw-Hill in 1952 and has written more than 75 technical articles on the subject.

E. B. Besselievre

Donald M. Baker, a partner in Ruscardon Engineers, of Los Angeles, which was recently dissolved as a result of the death of Rush T. Sill (see page 105), will continue to practice as a consultant at the same address, 448 South Hill St., Los Angeles.

Alton D. Taylor, formerly design engineer for T. H. McKaig, of Buffalo, N.Y., is now engaged as an associate professor and head of the civil engineering department at Ohio Northern University. While associated with T. H. McKaig, Professor Taylor was teaching evening classes at the Millard Fillmore College of the University of Buffalo. His experience in the field of education includes appointments at Norwich University and Northwestern Technological Institute.

Emerson B. Read was recently promoted to sales manager for Carleton Dooley, Realtor, Miami, Fla. He has been with the firm in a sales capacity since 1950.

Robert P. Scott, discharged from the U. S. Navy in mid-September with the rank of lieutenant junior grade following two years of service, has entered business with his father as a partner in R. P. Scott Contractors, of Chattanooga, Tenn.

Carl Henry Billings was recently appointed an instructor in civil engineering

at Texas Western College. Mr. Billings is a graduate of Michigan State College and has worked as a sanitation engineer for the city of Milwaukee and hydraulic engineer for the Corps of Engineers in Alaska.

George F. Nicholson, consulting engineer of Long Beach, Calif., announces that his office was moved to the Davies Building, 730 E. Third St., Long Beach, on October 11. He will continue to specialize in harbor and waterfront engineering and construction. The firm's Washington D.C., office which was closed during the war, will be reopened at its former address, 518 Union Trust Building.

Mason C. Prichard, well known senior civilian engineer with the Army Engineers, resigned from federal government service, October 24, to become executive vice-president of the Foundation Company, an international engineering and construction firm located in New York City. Engaged in engineering and construction on both civil and military programs of the Corps of Engineers for 28 years, Mr. Prichard in recent years has been chief engineering assistant to Brig. Gen. David H. Tulley, Assistant Chief of Engineers for Military Construction in the Office of Maj. Gen. S. D. Sturgis, Jr., Chief of Engineers, at Washington, D.C.

Non-ASCE Meetings

American Society of Mechanical Engineers. The 74th annual meeting will be held at the Statler, McAlpin and Governor Clinton hotels, New York, N.Y., November 28–December 3. For further details write to ASME Secretary Clarence Davies, 33 West 39th St., New York, N.Y.

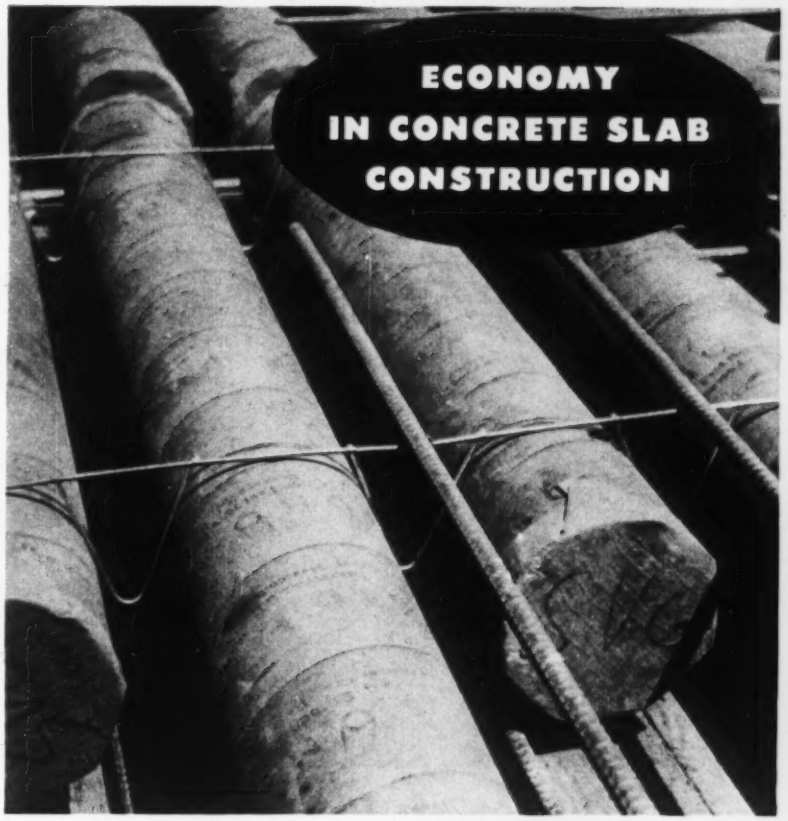
American Standards Association. Annual meeting at the Roosevelt Hotel, New York, N.Y., November 15–17.

Eastern Joint Computer Conference. Meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa., December 8–10. Inquiries should be addressed to P.O. Box 7825, Philadelphia 1, Pa.

Illinois Structural Engineering Conference. The third structural engineering conference will meet at the University of Illinois, Urbana, Ill., December 6–8. For additional information write to Prof. R. K. Newton, Division of University Extension, 116 Illini Hall, University of Illinois, Urbana, Ill.

National Association of Corrosion Engineers. Fourth annual conference of the Western Region at the Hotel Biltmore, Los Angeles, November 18–19.

Symposium on Civil Engineering Aspects of the Atomic Age. The Department of Civil Engineering of the Polytechnic Institute of Brooklyn will present the symposium at 99 Livingston St., Brooklyn, on November 20, from 10 a.m. to 4:30 p.m.



Central Assembly Church of God, Denver, Colo.
R. D. Peterson, Architect;
J. W. Sallada, Design Engineer;
Jack Cys, Contractor

SONOVOID
FIBRE TUBES
for voids in concrete construction

Hollows formed by inexpensive SONOVOIDS reduced the square foot cost of this concrete structure.

Illustration shows new method of spacing and anchoring SONOVOIDS by means of prefabricated lightweight metal wire.

Easy to handle low cost SONOVOID Fibre Tubes are specifically developed for use in concrete bridge deck, wall, floor and roof slabs. Used for prestressed and poststressed precast units or units cast in place. Contractors everywhere have learned that by using SONOVOIDS less concrete and less reinforcing steel is required at no sacrifice of structural strength.

SONOVOIDS are supplied in specified lengths or sawed to your requirements on the job. Sizes 2″ to 36.9″ O.D. up to 50′ long.

See our catalog in Sweet's
For complete technical data and prices, write

SONOCO PRODUCTS COMPANY
Construction Products Division
LOS ANGELES, CAL. — HARTSVILLE, S. C. — MAIN PLANT — MONTCLAIR, N. J.
AKRON, IND. — BRANTFORD, ONT.

sonoco
PAPER CARRIERS
REG. U.S. PAT. OFF.

NO TIME FOR DOWNTIME. Until this reservoir is completed, residents of Olathe will be paying premium rates for drinking water. That's why Contractor Lee Yerington says: *"On this dam I need plenty of power with a very minimum of downtime, and that's exactly what I get with my* INTERNATIONALS. *Take that TD-24 pusher, for example. 3500 hours on the meter and it still has original rails and never has had a major overhaul."*

"I needed durability ...my INTERNATIONAL'S delivered"

Contractor solves water shortage for Olathe, Kansas, with fleet of six INTERNATIONAL crawlers that never faltered in building a big dam and 160-acre reservoir

Water exporting business in Kansas City, Missouri, is due for a sharp slump due to the loss of 5,593 cash customers, the residents of Olathe, Kansas.

For many months past the thirsty population of Olathe has been supplementing the city's inadequate water supply by buying water by the tank car from Kansas City, but this condition is being rectified, and in a hurry.

The Yerington Construction Company, Parksville,

SOME BIG REASONS WHY earthmoving on this 450,000-cubic yard project moved at such a lively pace are apparent in this photograph: TD-24 speed that hauls heaped loads to the dam site at fastest traveling speeds. The positive rolling ejection feature of the INTERNATIONAL B-170A scraper spreads faster and completely cleans the bowl in the process.

A TRAP FOR CEDAR CREEK is shown taking shape as the INTERNATIONAL TD-24 and B-170A scraper begins another loading cycle in the bottom of the new reservoir.

Missouri, started construction of a new dam and 160 acre reservoir 2½ miles west of Olathe, and early in 1955 the city expects to be out of the water importing business.

Lee Dell Yerington is using a total of 21 pieces of equipment including 6 INTERNATIONAL tractors and scrapers to move 450,000 cubic yards of dirt and 60,000 cubic yards of rock on this hurry-up project, and here's what he says about his earthmovers:

"I like my INTERNATIONAL *equipment better than any other I have on this job—and for several reasons. I need plenty of power and plenty of durability and my IH crawlers deliver."*

Discover for yourself what this contractor has learned about how INTERNATIONAL crawlers and equipment deliver outstanding power and performance when the chips are down. Just call your INTERNATIONAL Industrial Power Distributor for your demonstration today. He'll bring the IH equipment you need to your job site anytime so you can get the lowdown on the IH rigs that mean more profitable business for you from here on in.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

ONE OF FOUR TD-18As the contractor used to hold a 7,000-cubic yard daily production average on this job is shown dozing dirt for a small temporary reservoir. This structure will be used in conjunction with the small natural lake as a reservoir until the new reservoir is completed.

UPGRADE WITH A HEAPED LOAD presents no problem for the Yerington's TD-24 with matched B-170A scraper hauling a solidly packed payload of 21 cubic yards.

INTERNATIONAL HARVESTER

INTERNATIONAL

FOR EVERY MOVE IN EARTHMOVING

Only 60 Seconds

To open a 24" gate valve

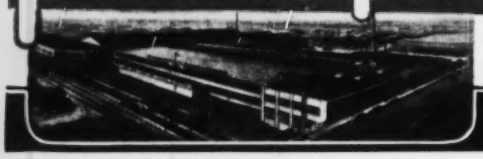
...instead of 12 to 15 minutes

with Limitorque

Think of the saving in man hours that could be effected in a year's time by the use of LimiTorque—not to mention the elimination of key men climbing to out-of-the-way, often times hazardous locations of important valves . . . Then too, when LimiTorque opens or closes valves, by the "*mere push of a button,*" the valves are operated at just the correct speed . . . and if an obstruction is encountered in closing, LimiTorque shuts off the motor, thereby preventing any possible damage to the valve seats, stems, discs or gates.
LimiTorque is operating thousands of valves throughout the World . . . day and night, on land and sea, in hot and sub-zero climates, indoors and outdoors . . . *Speedily—Safely—*and *Dependably*. LimiTorque Motor Operated Valves are readily adapted to Micro-wave Control.

Send for catalog L-54—and remember, *far more valves are operated by* LimiTorque than any other valve control.

Philadelphia Gear Works, INC.



ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

do you know that

Expansion of the Society's Highway Division is being studied? Revitalizing the Division in conformity with the new importance of highways in the national scene is urged by President Glidden in his inaugural address, which is given on page 40.

International Business Machines has the first all-transistor computer on record? Only one of many marvels in IBM's new electronics laboratory at Poughkeepsie, N. Y., the computer is made up of tiny transistors no bigger than the eraser on a pencil, each one of which is capable of receiving 1,000,000 impulses per second, can remember, and can perform selective functions. The whole computer draws no more power than the 300-w bulb in your home.

Sixty-ton piles are permitted in New York City's revised Building Code? The Corlears Hook Apartment House Development, probably the first project to take full advantage of the provision for use of increased loads on friction piles, will be described next month by J. H. Thornley, M. ASCE, president of the Western Foundation Corp. According to Mr. Thornley, many cities have similar building codes, whose provisions are not being utilized to the fullest extent.

Most of the New York State Thruway is open to traffic? With official opening of a 183-mile section from Newburgh to Utica on October 26, the Thruway is now 366 miles long—the world's longest toll road. Except for the 60-mile stretch between New York and Newburgh, the entire route is ready to speed the traveler on his way.

Surveyors have recently redefined their technical terms? Manual No. 34, "Definitions of Surveying, Mapping, and Related Terms," can be obtained from Society Headquarters in either cloth or paper binding (see order form in the advertising section).

Another record building year is predicted? In the opinion of Miles L. Colean, Washington construction economist and consultant, new construction expenditures next year will reach a record peak of $39 billion, an increase of almost $2 billion over this year's unprecedented outlays. Mr. Colean's forecast is summarized on page 76.

You have to contribute towards professional status? The doctor in Southern California pays $105 a year to his medical association, of which $80 is kept locally for his state and county organization, whereas ASCE members pay but $5 a year to the Los Angeles Section. The non-professional plasterer pays $60 a year to his local. These statements are made in a thoughtful Annual Convention paper, "The Young Engineer Looks at His Economic Position," which begins on page 53. The paper was presented by William J. Carroll, Jr., chairman of the Salary Committee of the Los Angeles Section's Junior Forum.

Drought conditions prevail in two-thirds of the nation? A serious drought, comparable to that experienced in the early 1930's, is building up in the southern and central states, according to recent records of the U.S. Geological Survey. In Tennessee storage in the principal tributary reservoirs of the TVA is two-fifths of normal and lower than ever experienced this time of year.

Two big engineering colleges are celebrating their centennials this year? The centennial theme of the New York University College of Engineering will be "Teaching and Research Build the Future," and of the Polytechnic Institute of Brooklyn, "Science, Engineering, Research for Human Well-Being."

You are now getting more free Proceedings-Separates? As a direct result of the dues increase, any member of the Society may obtain as many as 100 free Proceedings-Separates in addition to all the papers issued by the Division in which he is registered. Details in the September issue (page 82) and instructions in this issue (page 123).

It is not too late to get the Index for 1953 "Civil Engineering"? Also available from ASCE Headquarters are indexes for all previous years except 1943–1946, inclusive.

Work has already started on both the seaway and power phases of the St. Lawrence Seaway Project? A detailed Annual Convention paper on the $900,000,000 project is the lead article in this issue.

'LET THERE BE LIGHT'

'Showcase' Bank Illuminates Cold-weather Advantages of 'Incor' Concrete

● Let there be light—and plenty of it—was clearly the objective in designing this beautiful new bank, largest of Manufacturers Trust Company's 111 metropolitan New York branches, recently opened at Fifth Avenue and 43rd Street. The $3-million building, with its five floors enclosed in huge glass panes, has a wide-open, inviting look, reflecting the fact that banking is a selling service—and this one has the largest showcase in town.

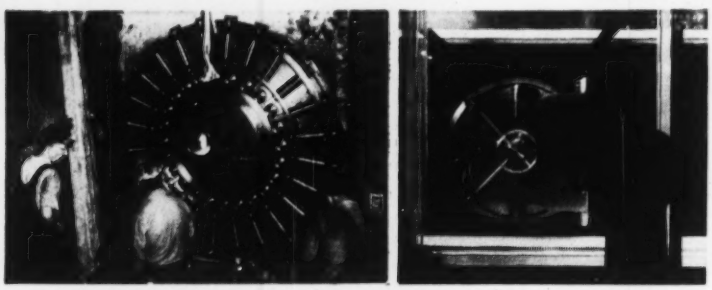
No matter what the design, concrete helps give enduring substance to the designer's creation, and somewhere on every job 'Incor' 24-Hour Cement fits in, to speed concreting and minimize costs. Here, much of the work was done in cold weather, and 'Incor' concrete was used in the 28-ft.-span east-west joist construction with 10-ft. cantilever on Fifth Avenue, in fireproofing, and in the massive vault on the main floor.

Regardless of building type, an 'Incor'* schedule usually shows the lowest cost, saving up to two-thirds on forms through faster re-use, with the added Winter advantage of eliminating frost risks with only one day's heat-protection instead of the usual 3 to 5 days. It pays to use America's FIRST high early strength Portland cement, for summer speed in winter work . . . for quality concrete at lowest cost.

*Reg. U. S. Pat. Off

Placing 'Incor' concrete for New York's handsome 'showcase' bank, recently opened by Manufacturers Trust Company, at Fifth Avenue and 43rd Street, New York City.

MANUFACTURERS TRUST COMPANY
Bank Building—5th Ave. & 43rd. St.
Architects: **SKIDMORE, OWINGS & MERRILL**
Structural Engineers: **WEISKOPF & PICKWORTH**
General Contractor: **GEO. A. FULLER CO.**
Concrete Contractor:
CHARLES RIZZI CONSTRUCTION CO., INC.
Ready-mix 'Incor' Concrete:
JAMES A. NORTON, INC.
—all of New York City



The new bank's giant Mosler vault, on the main floor, flood-lighted at night, clearly visible to passers-by, contains 304 cu. yd. 'Incor' concrete.

LONE STAR CEMENTS COVER THE ENTIRE CONSTRUCTION FIELD

LONE STAR CEMENT CORPORATION

Offices: ABILENE, TEX. • ALBANY, N.Y. • BETHLEHEM, PA. BIRMINGHAM • BOSTON • CHICAGO • DALLAS • HOUSTON INDIANAPOLIS • KANSAS CITY, MO. • NEW ORLEANS • NEW YORK NORFOLK • RICHMOND • WASHINGTON, D.C.

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 18 MODERN MILLS, 136,000,000 SACKS ANNUAL CAPACITY

CIVIL ENGINEERING
NOVEMBER 1954
THE MAGAZINE OF ENGINEERED CONSTRUCTION

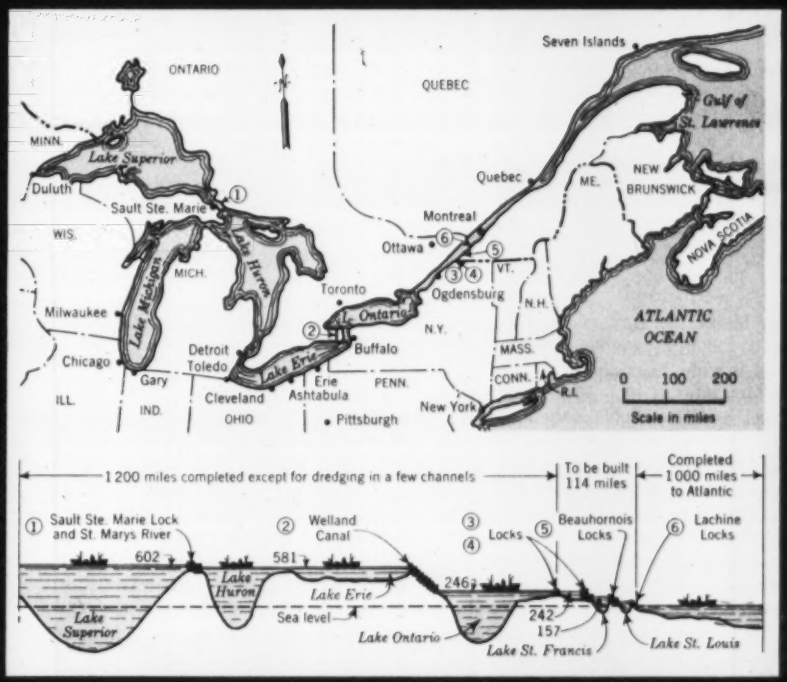


FIG. 1. St. Lawrence Seaway and Power Projects are independent but closely interrelated. Seaway Project will provide inland waterway for ships of 27-ft draft all the way from Atlantic Ocean to Lake Superior. Power project will utilize uniform flow due to Great Lakes storage to generate some 1,880,000 kw at Barnhart Island Powerhouses, half for Canada, half for United States.

EMERSON C. ITSCHNER

M. ASCE

Brigadier General, U. S. Army

Assistant Chief of Engineers for Civil Works

Washington, D. C.

St. Lawrence Seaway and Power Projects started

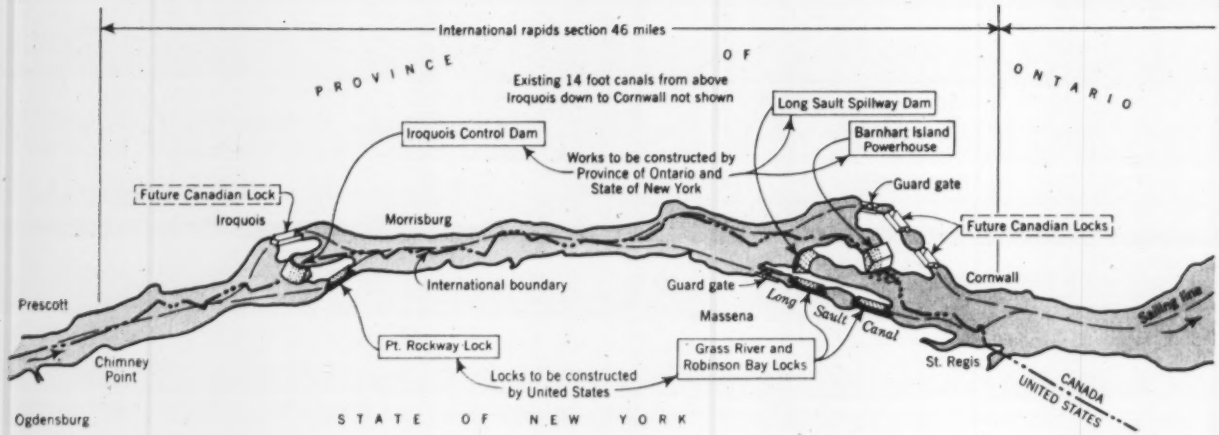
The St. Lawrence Seaway and the St. Lawrence Power Projects are soon to become a reality in spite of the many years of intense opposition by those who feared their interests would be affected adversely by these developments. The navigation project was called the "St. Lawrence Iceway," and full-page advertisements run in Washington, D.C., newspapers at the time the Seaway was being considered by Congress depicted an ice-jammed river, a very persuasive argument against the project to a reader not acquainted with the facts. Its opponents stated that the Seaway Project would cost two billion dollars, a grossly padded figure which could only have been obtained by including, in addition to the cost of the Seaway, the cost of deepening all the connecting channels and all the harbors, however small and unimportant, on the Great Lakes. No doubt there will be a demand for developing the connecting channels and the more important commercial harbors to accommodate the great increase in commerce that the Seaway will encourage, but each such project will require complete economic justification and specific authorization.

The Power Project will produce a substantial block of much-needed power which will be secured at low cost, and without further depleting the diminishing supply of thermal-plant fuels.

The Seaway and the Power Project are independent but closely interrelated, each of the greatest importance to both the United States and Canada. Both nations will contribute to their cost, and both nations will participate in the benefits. As this article indicates, the organizational structure established to accomplish the combined projects is most complex. Nevertheless, complete coordination has been effected, and no difficulty is seen in completing the project to the satisfaction of all the agencies involved.

St. Lawrence Seaway Project

The signature of President Eisenhower, affixed on May 13, 1954, to the Wiley-Dondero Seaway Act (Public Law 358, 83d Congress, 2d Session) authorizing United States participation with Canada in the construction of the St. Lawrence Seaway, culminated thirty years of effort to bring ocean transportation to every port on the Great Lakes. Water-borne traffic between tidewater and Lake Superior has had to overcome a series of rapids in the 114 miles from Montreal to Ogdensburg, N.Y., and the connecting passages between the several lakes. Since early in the nineteenth century, Canada has progressively improved navigation conditions in the St.Lawrence, principally by constructing canals around the worst rapids, until a 14-ft channel was com-



pleted about the turn of the century. There are 22 locks, each only 252 ft long and 44 ft wide, providing a total lift of approximately 200 ft. This outmoded channel is completely inadequate to serve the demands of modern ocean-going commerce and constitutes a bottleneck in its development. Cargoes have been limited to 3,000 tons; nevertheless, 10 million tons of traffic passed through this system in the last year of record. This tonnage, while large for an inland waterway, is much less than the extremely heavy and important Great Lakes traffic, which moves in ships up to 600 ft long or more carrying up to 20,000 tons, at maximum drafts greater than 24 ft.

The United States portion of the St. Lawrence Seaway Project is limited to the bottleneck reach 114 miles long from the International Boundary near St. Regis, N.Y., westward to Lake Ontario, with the major work centered in the downstream 46-mile section of that reach, known as the International Rapids Section (Nos. 3 and 4 in Fig. 1). In this reach the Seaway Act provides for the construction of a channel at least 27 ft deep, with lock sills at least 30 ft deep.

Canada's Seaway Project includes deepening the Welland Canal (No. 2 in Fig. 1), which is the connecting channel between Lakes Ontario and Erie, from its present controlling depth of 25 ft to 27 ft. The lock sills in the canal are already at 30 ft. The major part of the Canadian work, however, will be in the 68-mile section of the St. Lawrence from Montreal westward to the International Boundary (Nos. 5 and 6 in Fig. 1).

As a rough preliminary estimate, the total Seaway Project will cost $305 million, divided $105 million for the United States and $200 million for Canada, as shown in Table I.

United States Seaway Work

The International Rapids Section, as authorized by the Seaway Act, consists of the construction of two canals and appurtenant locks. The Long Sault Canal, 8 miles long (No. 4 in Fig. 1), will bypass the Long Sault Dam, which is part of the Power Project. It will contain two locks, the Grass River Lock and the Robinson Bay Lock. The legislation authorizes these locks to be at least 800 ft long and 80 wide, with a depth of 30 ft over the sills and a lift of about 40 ft. The design contemplated allows for a reasonable deepening when shipping requires it. Consideration is being given to increasing the dimensions of these locks above the minimum specified to satisfy more fully the requirements of modern shipping. However, present indications are that the locks in the Canadian Section downstream will be constructed to the minimum dimensions contemplated in the Wiley-Dondero Bill, which are the same as those prevailing in the Welland Canal locks upstream.

The second canal authorized by the Seaway Act, the Point Rockway Canal (No. 3 in Fig. 1), is 3 miles long. It will bypass Iroquois Dam, which is the control dam for the power project. The Point Rockway Lock located in this canal will have the same dimensions as the other locks, except that the lift will be only from less than 1 to 5 ft. A shorter alignment, which promises a reduced cost, is now under study.

Existing Cornwall Canal bypasses International Rapids on Canadian side, providing normal operating draft of 14 ft. Photo by Capital Press Service.

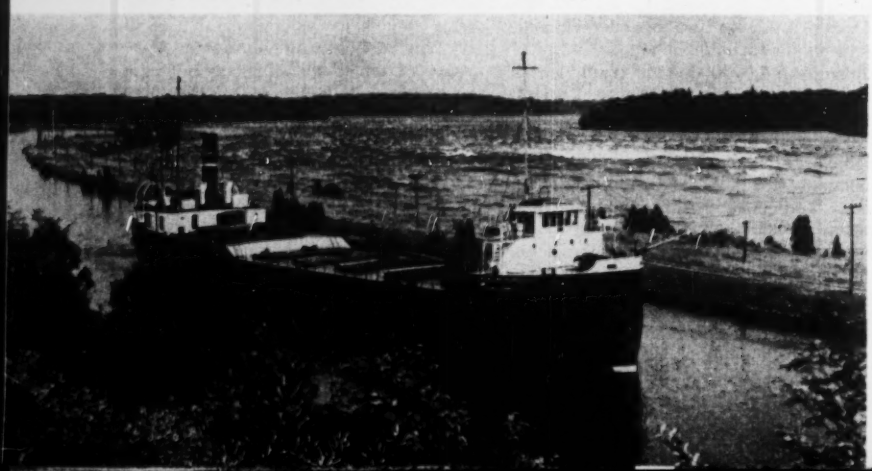


TABLE 1. Estimated division ofcost of St. Lawrence Seaway Project

	Cost in Millions
United States sections:	
International Rapids (46 miles), from International Boundary to Ogdensburg	$103
Thousand Islands (68 miles), from Ogdensburg to Lake Ontario	$ 2
	$105
Canadian sections:	
Montreal-International Boundary (68 miles)	$198
Welland Canal (28 miles)	$ 2
	$200

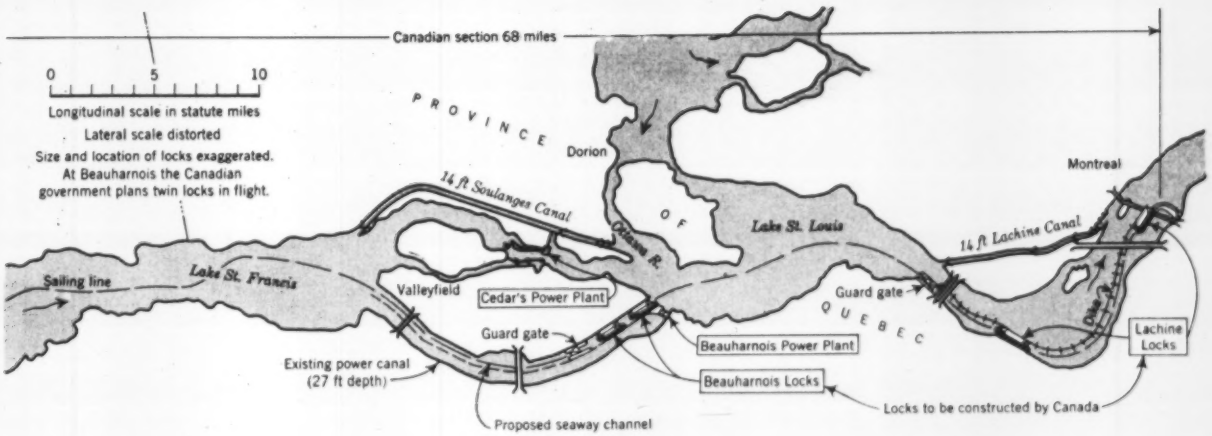


FIG. 2. Principal construction for both Seaway and Power Projects is concentrated in reach 114 miles long between Ogdensburg, N.Y., and Montreal, Canada.

The Thousand Islands Section, which essentially is an estuary of Lake Ontario, requires the removal of scattered rock shoals to provide a channel not less than 450 ft wide and 27 ft deep.

Many decisions affecting the design of the various components comprising the Seaway have been made, and others are still pending. Among the more important of these decisions are the elimination of the Long Sault guard gate (Fig. 2). This structure as formerly proposed was to be near the upper end of the Long Sault Canal. Its purpose was to prevent loss of the pool in case of serious dike subsidence or failure of the gates of the Robinson Bay Lock. It is believed that the cost of this structure is not justified, since the dikes upstream would not be protected by it, and adequate safety features for the lock gates can be incorporated in the lock itself. Also, the guard gate would constrict the channel and slow the movement of traffic in the canal.

Another decision is that long guide walls, perhaps in excess of 2,000 ft, will be built to promote safety and speed in maneuvering ships through the locks. With a long guide wall, the risk of ships damaging the lock gates will be reduced, and ships can be moored along the wall while traffic is maintained past them into and out of the lock chamber. The locks will be located at one side of the canal to provide space for future parallel locks if and when the volume of traffic justifies additional facilities, although it is possible that the first duplicating waterway will be constructed by Canada on its side.

Another projected change concerns the Iroquois Dam, which the Power Authority of the State of New York now proposes to build about 3,000 ft downstream from the location originally proposed. This will permit the realignment of the Point Rockway Canal on a shorter route at a considerable saving in excavation costs, provided navigation conditions at the downstream entrance are favorable. Studies, including borings and quantity estimates, are being made of the proposed new location.

The design of the filling and emptying systems at the Grass River and Robinson Bay Locks will be based on the results of model tests. Such tests on barge-lock models have been made, but no data are available on ship locks of this size and lift. It is particularly important to obtain information on the maximum hawser pulls to be expected during filling and emptying operations, for the conditions that will prevail on this particular waterway. Also, the dredging of some areas below the Grass River Lock will be determined by model studies of the current patterns and velocities. The provision of proper navigation conditions in river cuts is a responsibility of the Power Authority.

Because of their record of dependability and economy, miter gates will be provided in the Grass River and Robinson Bay Locks. Sector gates may be installed in the Point Rockway Lock for possible use in flushing ice through the canal, and perhaps for filling and emptying if model tests show it to be feasible. Although a considerable saving in first cost could be effected by providing only single gates at the Grass River and Robinson Bay Locks, duplicate gates may be justified to shorten the period during which the waterway would be closed in case of gate damage. This also follows the precedent set on some other ship canals, including the Welland Canal and Sault Ste. Marie.

Records of lock operation at Sault Ste. Marie show that the fender booms in the lock chambers above the lower gates have been struck occasionally, but that the outside booms have never been needed. In view of this experience and the long guide walls to be provided, it is proposed to reduce the number of fender booms. One will be installed above each lower gate in each lock and, in addition, one below the upper gate at Point Rockway, because of the low sill, and one above the upper gate at Robinson Bay because of the importance of that gate in retaining the pool.

The one important highway crossing of the Long Sault Canal will be either at high level or in a tunnel, so as to avoid all interference with navigation. Other highway and railroad crossing will be on low-level movable spans, since land traffic will be light and the movable spans can normally remain in the open position.

In order to complete the Seaway facilities by late 1958, and also to meet certain limitations set up by the Seaway Act on expenditures in any one year, it is necessary to get construction of some features under way early in 1955. The first contracts to be let will be for excavation of parts of the Long Sault Canal. Work on the Point Rockway Canal will be deferred pending a final decision on its location.

The Seaway Act created the St. Lawrence Seaway Development Corporation as the agency to construct and operate the United States part of the Seaway, under the direction and supervision of the President or the head of an agency designated by him. An Executive Order of the President has placed the Corporation under the direction and supervision of Secretary of Defense Wilson, who has delegated this function to Deputy Secretary Anderson. Lewis G. Castle, formerly president of the Northern Minnesota National Bank, of Duluth, has been appointed by the President as Administrator of the Corporation. M. W. Oettershagen, formerly Chicago port engineer, is Deputy Administrator. The President also has appointed a capable and distinguished group of men as the Advisory Board of the Corporation. The Corps of Engineers has been designated by the Administrator as the designing and constructing agency under the general di-

FIG. 3. Proposed dams and powerhouses at Barnhart Island—main features of Power Project—appear in schematic profile along International Rapids Section. Work on both Power and Seaway Projects has already begun.

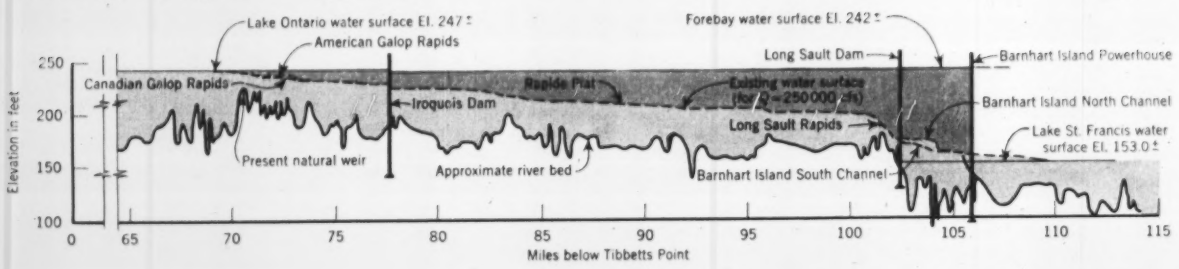


Photo Above:

St. Lawrence Power Project, authorized to be built jointly by Province of Ontario and State of New York, involves construction of Iroquois Dam to control level of Lake Ontario, and 27 miles downstream, Long Sault Dam and Barnhart Island Power Dam. Included in Seaway Project are Long Sault Canal and Locks, seen at left, which will carry water-borne traffic around International Rapids section of river on United States side.

rection of the Corporation. Supervision of the work assigned to the Corps is being accomplished by the North Central Division, Chicago, under Col. Wendell P. Trower, and the field agency is the Buffalo District, with Col. Loren W. Olmstead as District Engineer.

On the Canadian side, work in the Lachine Reach, just upstream from Montreal, will consist of a canal 17 miles long with two locks, each 800 ft long, 80 ft wide, and having a 30-ft depth over the sill, according to the latest published Canadian plans (Fig. 2). The lower lock will be at Montreal and the upper lock just above Lachine Rapids. Current plans are understood to provide for a guard gate above the upper lift lock. Dredging will be required in Lake St. Louis, which lies upstream of Lachine Rapids.

In the Soulanges (Beauharnois) Reach there is an existing power canal 15 miles long, now serving the Beauharnois Power Plant, which will be utilized for the Seaway. Dredging to improve the canal has been completed. A new short side canal, with a guard gate and twin flight locks, each of the same size as those planned for the Lachine Reach, is planned at the lower end of the power canal.

Dredging of shoal areas in the Lake St. Francis Reach will be required.

The St. Lawrence Seaway Authority was created by an act of the Canadian Parliament on December 21, 1951. The president of the Authority is Hon. Lionel Chevrier; the vice-president is Charles Gavsie; and C. W. West is a member. For the Authority, A. G. Murphy is Chief Engineer, and R. A. C. Henry, consulting engineer.

Commerce will be heavy

Existing commerce on the Great Lakes is extremely heavy, and on the St. Lawrence River it is sizeable considering the difficulties presented by the existing waterway.

As a result of the Seaway improvement, it is estimated that commerce on the St. Lawrence above Montreal will increase from the existing 10 million tons annually to between 45 and 50 million tons annually after a reasonable development period. The saving to shippers is expected to be about $60 million a year, whereas the annual cost is of the order of $15 million, resulting in a saving to commerce and industry of four dollars for every one dollar of cost. This is an unusually high return on a waterway investment, and is the more remarkable because the river will be open to navigation only eight months of the year because of winter ice conditions. This same situation, however, prevails on the Great Lakes, where the connecting channels freeze during the winter.

In a future emergency, we shall have to look to foreign sources for iron ore, a situation we have not had to face in the past. The St. Lawrence Seaway, by providing low-cost transportation from a dependable wartime source of iron ore in Labrador, relatively well protected from submarine attack, may prove to be invaluable.

Construction schedules for the Seaway and for the Power Project must be coordinated, because the Seaway utilizes the pool created by the power dams in the International Rapids Section. Also, existing river traffic should not be interrupted if it can be avoided. Therefore it would be preferable, from the standpoint of navigation, to make the change-over during the winter when navigation is not feasible because of ice. It is planned to complete construction of the Seaway late in 1958 and to open it to navigation not later than the spring of 1959. Present plans are that bids for the first major United States canal excavation contract in the vicinity of Massena, N. Y., will be opened late this year, and some preliminary work will be started before the end of 1954.

The Seaway Project is not coupled in any way with the projected deepening of channels and harbors on the Great Lakes, yet it is inevitable that there will be a great demand for such deepening in order to extend the benefits of the Seaway. At present, at low-water datum, depths of 21 ft are available upbound and 25 ft downbound, in the connecting channels. A detailed study of the requirements in connecting channels has been in progress for the past two years by the Corps of Engineers, and it is anticipated that a report on the subject will be made to Congress early in the next session. This report will consider the economic feasibility and desirability of deepening the connecting waterways to 27 ft.

A preliminary estimate indicates that the new work will cost in the neighborhood of $110 million. Additional work will be required in many of the harbors served by this deepened channel, but the extent of such work and its estimated cost cannot be determined without a considerable amount of study. It should be emphasized that such work will be recommended only if justified by the additional traffic and transportation savings obtainable under existing conditions, supplemented by the St. Lawrence Seaway.

St. Lawrence Power Project

Like the Seaway Project, the Power Project is a joint United States–Canada enterprise. However, the power project is being constructed by state and provincial agencies instead of by a federal corporation or authority.

The Power Project was approved by the International Joint Commission, by an Order of Approval dated October 29, 1952, for construction and operation jointly by the Hydro-Electric Power Commission of Ontario and an entity to be designated by the United States Government. On July 15, 1953, the Federal Power Commission granted a license effective November 1, 1953, to the Power Authority of the State of New York to construct and operate the United States part of the power works, and in an Executive Order issued November 4, 1953, the President officially designated the Power Authority as the United States agency to develop the power phase jointly with Ontario Hydro. The Supreme Court, on June 7, 1954, dismissed a petition of the Lake Ontario Land Development and Beach Protection Association, thus freeing the project to proceed.

Provisions were contained in the International Joint Commission Order approving the power development for the establishment of an international board of engineers, known as the St. Lawrence River Joint Board of Engineers, with responsibility for passing on plans, specifications, and construction schedules of the constructing agencies and for the protection of the federal interests of the two governments. The Board consists of four members, two comprising the Canadian Section and two the United States Section. In addition, each member has designated an alternate to act for him in Board matters. The Canadian Section, which was established by an Order-in-Council dated November 10, 1953, is composed of the Hon. Lionel Chevrier, formerly Minister of Transport and now President of the St. Lawrence Seaway Authority, and R. A. C. Henry, consulting engineer, as members. Their alternates are Brigadier Maurice Archer, Vice Chairman of the National Harbours Board, and M. V. Sauer, consulting engineer.

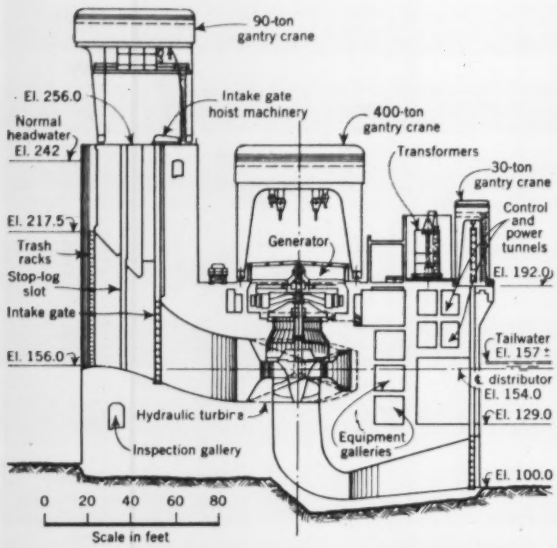
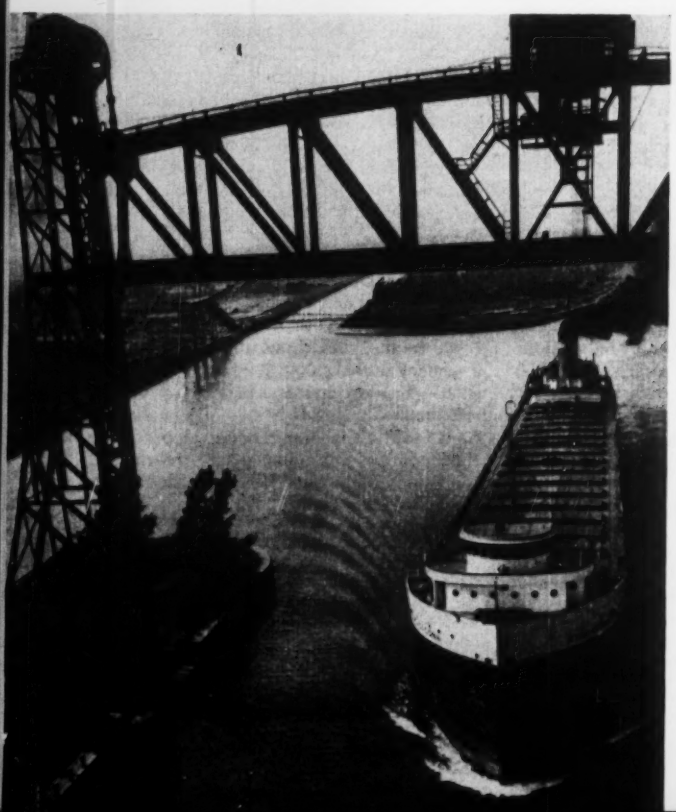


FIG. 4. Barnhart Island Powerhouses will contain 32 turbine generator units, each of 57,000 kw—16 on each side of International Boundary. Maximum total output is estimated at 1,880,000 kw.



Existing Welland Canal, 28 miles long, extending around Niagara Falls on Canadian side, will be deepened from 25 ft to 27 ft. Lock sills are already at 30-ft depth. Photo by Malak, Ottawa.

The Executive Order which designated the New York Power Authority as the United States power entity, also established the United States Section of the Joint Board, consisting of Secretary of the Army Robert T. Stevens and the Hon. Jerome K. Kuykendall, Chairman of the Federal Power Commission. Secretary Stevens has designated as his alternate Maj. Gen. B. L. Robinson, Deputy Chief of Engineers for Construction, and Mr. Kuykendall has designated Francis L. Adams, M. ASCE, Chief of the Bureau of Power of the Federal Power Commission, to act as his alternate. A small technical staff has been established, with headquarters at Massena, N.Y., to provide engineering support to the United States Section of the Board. This staff is headed by Robert H. Hayes, Chief Engineer.

The International Boundary lies generally along the thalweg of the 114-mile reach of the St. Lawrence below Lake Ontario. The International Rapids Section is in the reach in which the power head is produced. Each nation is entitled to one-half of the flow of the river along the boundary, and likewise one-half of the power, which is estimated to average 12.6 billion kwhr annually. Monthly mean flows vary between 152,000 and 317,000 cfs, with an average of about 240,000 cfs. The river falls 92 ft in 46 miles, or an average of 2 ft per mile.

An existing hydroelectric project of the Aluminum Company of America at Massena, N.Y., has been in operation for almost 60 years. It develops about 80,000 hp, using the Massena Power Canal which discharges into Grass

River, a tributary of the St. Lawrence. The project uses only a small part of the river flow and but 43 ft of the head available in the downstream portion of the International Rapids Section. Under the provisions of the Federal Power Commission license, a determination will be made as to whether this plant will remain in operation during the construction phase of the project and thereafter.

The Power Project will be developed in general accordance with the report prepared in 1941 by the U.S. St. Lawrence Advisory Committee and its Canadian counterpart. The design will be based to a large extent on plans prepared by the Massena District of the Corps of Engineers in the period 1940–1942 in response to an Executive Order of the President dated October 16, 1940. The Massena District was established especially to prepare the plans and specifications for the development of both the Seaway and the Power Projects in the International Rapids section of the St. Lawrence, and their final report was submitted in 1942.

As shown in Fig. 3, the principal features of the Power Project are:

1. Two identical, adjacent powerhouses across the north channel connecting the downstream end of Barnhart Island and the Canadian mainland, one in the United States and the other in Canada.
2. Long Sault Dam across the south channel connecting the upstream end of Barnhart Island and the United States mainland.
3. Dikes on both mainlands and between Long Sault Dam and the powerhouses.
4. Iroquois Control Dam in the upper part of the International Rapids Section.
5. Channel enlargements.
6. Relocations of railroads and roads and parts of two Canadian towns.

Iroquois Dam will be constructed across the St. Lawrence River approximately seven miles downstream from Ogdensburg, N.Y. Basically its purpose is to control the level of Lake Ontario, independently of downstream operations, and to facilitate the formation of a solid ice cover on the upper river to reduce the problem of floating ice at power intakes. It will permit fluctuation of the lower pool in connection with power operations without adversely affecting lake levels or introducing flow velocities through restricted reaches higher than desirable for navigation, and can be used to dampen seiches caused by barometric changes. It also will permit operation of the power pool during an initial test period at a maximum elevation of 238, as required by the Order of Approval of the International Joint Commission, with lake levels retained at a higher elevation.

The water surface in Lake Ontario will be maintained at levels within the range of fluctuations under natural conditions, varying between Els. 242.5 and 249.5. The head will vary between less than 1 ft and 5 ft at the dam. The dam will consist of a gated spillway structure flanked by concrete non-overflow sections on each end, spanning the main channel. Earth-fill dikes on each extremity will complete the closure. The control gates will be of the vertical-lift type, operated by two gantry cranes.

In order to form the power pool, two channels must be closed, one on each side of Barnhart Island. Long Sault Dam closes the channel between Barnhart Island and the New York shore, and the two powerhouse structures dam the river between Barnhart Island and the Canadian shore. The International Boundary passes between the two powerhouses.

The Long Sault Dam is curved upstream in plan. Normal headwater will be initially at El. 238, although it is proposed to increase it later to El. 242, and normal tailwater will be about El. 157, creating heads of 81 and 85 ft respectively. The gated spillway section will be flanked by concrete non-overflow gravity dams on each end. The spillway section, which will be about 2,390 ft long, will be controlled by vertical-lift crest gates, operated by two gantry cranes. The maximum height of the dam above its foundations will be 145 ft.

All power in the project will be generated in the twin powerhouses (Fig. 4). The intake structures, which also serve as the dams across the north channel, will be integral with the powerhouses. On the basis of the development of detailed planning to date, it is expected that the power installation and capacity of the two plants will be as follows: There will be 32 turbine-generator units, 16 in each powerhouse. The turbines will be of the fixed-blade propeller type, designed to develop 71,000 hp at best gate with 81 ft of head. The generators will have a nameplate rating of 57,000 kw, with the usual capability of operation at 15 percent overload. Taking into account the increase in tailwater elevation at high rates of discharge through the turbines, the maximum output of the powerhouses with all 32 units in operation is 1,880,000 kw.

The Order of Approval of the International Joint Commission provides for operation initially with a maximum forebay water level at El. 238 for a test period of ten years, or such shorter period as may later be approved by the Commission. Provision also is made in the Order for temporary modifications in this operating level during the test period in order to carry out experiments as to the advisability of increasing the maximum water level permitted. On completion of the test period, the Commission will make recommendations to the two governments with respect to the maximum pool level it considers desirable on a permanent basis, and the determination of the permanent maximum operating pool level will be the subject of a future agreement between the two governments.

At a minimum average monthly flow of 180,000 cfs, which it is estimated will obtain with the method of operation contemplated initially, the calculated prime capacity is 1,400,000 kw. Of the 13 billion kilowatt-hours of average annual energy available, 10.4 billion kilowatt-hours will be firm energy.

Special measures must be taken because of the cold winter weather occurring in this area. Channel improvements look toward the formation of a solid ice cover on the pool to avoid the risk of clogging intakes with running ice and the formation of under-hanging ice dams. To accomplish this purpose it is necessary to limit velocities in the pool to $2^1/_4$ ft per sec. All the dams will be equipped with air-bubbler systems on the upstream face and electric heaters for the gate guides so that the gates can be operated in the coldest weather.

A few cost estimates

The New York Power Authority estimates the cost of its share of the power project at $315 million. Its annual charges, including operation and maintenance, are estimated to be approximately $20.5 million. This amount is increased to $26.3 million when the cost of transmission facilities to bring the energy to the load center is added. Equivalent steam power is estimated to cost $39 million annually, or $12.7 million more than hydro.

The Power Authority of the State of New York, Robert Moses, Chairman, has W. S. Chapin as general manager and J. Burch McMorran, M. ASCE, as chief engineer. Plans and specifications are being prepared by Uhl, Hall and Rich—an affiliate of Charles T. Main—which will also supervise and inspect construction for the Power Authority.

Robert H. Saunders is chairman of Ontario Hydro and Dr. R. L. Hearn, M. ASCE, is its general manager and chief engineer. It will do its own engineering and field inspection.

(This article has been prepared from General Itschner's address before the St. Lawrence Seaway Luncheon, sponsored by the Waterways, Hydraulics, and Power Divisions at ASCE's Annual Convention in New York.)

New President deals with current Society issues in

WILLIAM ROY GLIDDEN, President, ASCE; Assistant Chief Engineer, Virginia Department of Highways, Richmond, Va.

The official nominee for ASCE President, named in June of each year, is privileged to attend meetings of the Board of Direction and its Executive Committee from June to October. When he becomes President of ASCE in October he can begin his term of office with a background of current Society affairs and problems. Working with the Board of Direction, your President this year, like those who have preceded him, will devote his earnest efforts toward solving these current problems. I propose also that the Board and every member of the Society endeavor further to strengthen the historic position of ASCE as an effective champion of the principle that engineering is, in fact and practice, one of the learned professions.

Of our several internal problems there are two which are presently familiar to me, and which seem to demand early attention. The first is the question of Districts and Zones. The second is activation of the Highway Division.

Districts and Zones

There has been no major shifting of District and Zone boundaries since 1943, when much needed revisions restored the Society population to approximately the balances required by the Constitution. An examination of the 1954 Official Register reveals glaring inconsistencies which have resulted from a marked dispersion of membership residence. According to the Official Register, we had 36,250 members on January 1, 1954, and the representation unit, for which one Director is provided, consists of 1,908 members. We find, however, that in District 3 there are 1,070 members and in District 5, 1,261 members, each only 56 and 66 percent respectively of a full representation unit. On the other hand, District 10 with 2,542 members, and District 15 with 2,676 members, exceed the number required for a representation unit by 34 and 41 percent respectively. In the Texas Section alone there are 1,887 members. We are confronted with the anomaly of a number of Sections with a membership exceeding that of some Districts. Year after year the Board has sniffed at the problem but has found the aroma unpleasant. In the interest of fairness to large numbers of our members and an honest application of the constitutional provision for proportionate representation, it is to be hoped that the 1955 Board of Direction will face the problem squarely and will solve it.

Highway Division

Today we talk of needed highway construction in terms of billions of dollars, and President Eisenhower's recent proposal to spend $50 billion of federal money on highways over the next ten years conforms with the spirit of the times. We are indeed moving into a new era in highway engineering, construction, and finance. In conformity with the larger place highway activity occupies and will occupy in civil engineering and the national economy, we should take a new look at our Highway Division. Authorized in 1922 as a skeleton organization, it is now falling behind the accelerated advance in this important branch of the profession. It is high time that the Highway Division be augmented and strengthened.

The possibilities of cooperative effort among the Society, the American Association of State Highway Officials, and the Highway Research Board should be explored. This would require an exchange of views and possibly a meeting of the chairman and perhaps other members of the Executive Committee of the Highway Division with the Secretary of the AASHO and the Director of the HRB, together with such other members of these respective organizations as may be helpful.

The work of committees now set up in the Highway Division should be activated and, in my opinion, at least three new committees should be appointed.

The planning and operation of a highway, or a system of highways, is fundamentally affected by the traffic anticipated and realized. A continued study of traffic behavior is essential for an intelligent appraisal of current problems and future needs. It is recommended that a committee be appointed to study patterns and influence of traffic and its impact on the design of highways and appurtenant facilities.

With modern multi-lane highways often costing over a million dollars a mile, the subject of the economics of highway design and construction looms large. Creation of a Committee on Highway Finance and Economics seems overdue. Another committee with major potentialities for ASCE would be an active Highway Division Committee on design and geometric standards.

The urgently needed increased activity in our Highway Divison would be a stimulus to many engineers in the highway field to participate in the affairs of the Society. Highway engineering is civil engineering, but the American Society of Civil Engineers has almost abdicated this area of our profession. For example, in the twelve-month period ending August 1954, ASCE published 224 PROCEEDINGS papers. Of these, the Highway Division contributed six, or but 2.7 percent of the total output. I am convinced that the Society and the public would benefit through a reestablishment of such leadership.

Professional Ethics and Public Works

Practically every unit of government charged with construction—federal, state and local—has its own engineering department. Some are large, such as the Bureau of Public Roads, the Bureau of Reclamation and the civil works section of the Army Corps of Engineers. Others grade down to one- or two-man size in the smaller units of local government. These governmental engineering units, large and small, do their own everyday routine design, construction, and maintenance work. Often they have unusual projects or programs of a temporary nature thrust upon them for which sound economy dictates the employment of outside private engineering organizations.

Regardless of size, these public engineering units have the responsibility of expending funds of the public in construction for the public, in the best interest of the public, which pays the bill in taxes or assessments. When it is found necessary for a unit of government to employ outside engineering services, there is a right way and a wrong way. The responsibility rests on both the governmental unit and on the outside engineering organizations which might be interested.

A public administrator must be very circumspect in his choice of an outside engineer and must be able to defend his choice. It is a source of much disillusionment to observe, when a public works job is in the offing, how some members of our noble profession attempt to browbeat public officials, resort to newspaper propaganda, invoke political influence, and infest public engineering offices in order to secure a professional engagement. This condition is by no means general, but it happens all too frequently.

The easy way for the public official to avoid much of this type of pressure or political attack, and at the same time,

knowingly or unknowingly, to deceive his constituents into believing that he is acting truly in the public interest, is for him to advertise for bids for the furnishing of engineering services. This is done in much the same manner as advertising for lumber, steel, or portland cement. As a sad commentary, consider a recent observation by the governor of one of our great states. He recently replied to an ASCE complaint by saying that, "The only means that the governor has of protecting himself against [such] malicious attacks is to obtain competitive bidding in every instance where it is possible."

What this governor and the fortunately but few other like-minded public officers need is education on the facts of engineering and professional services. ASCE Manual No. 29, on Professional Practice, a copy of the ASCE code of Ethics and a reprint of an article in the May 1954 issue of CIVIL ENGINEERING titled "Competitive Bidding for Professional Services Not in the Public Interest," would furnish him needed elementary information. Conferences with representatives of local and national engineering societies would supplement such primary information.

Action by a public official contrary to the public interest in order that he may avoid possible criticism, as contemplated by the governor mentioned, is indeed a weak defense. Does not the governor know that every man elected or appointed to public office must expect to carry his share of grief? It goes with the job. Every man in responsible charge of any endeavor must carry his burden of headaches and heartaches. If there were no such burdens, the responsible man would not be needed. We grow and gain strength in proportion to the weight of our burdens. Did the governor ever solicit any advice or assistance from the Society? With 102 years of experience behind us, certainly we could be helpful. Does the governor share in the popular misconception that price alone defines competition? We are not condemning competition. Competition in a free society is the catalyst that made this country great. We condemn, and every taxpayer should condemn, competition on a price basis, where the professional quality of the service required is ignored or subordinated.

The sole object of competitive bidding is a low price. There can be no other reason. It is a good reason only when the thing to be purchased can be specified in detail. Professional services in engineering, law, or medicine are not amenable to detailed specifications. When engineers bid for the furnishing of professional services for a project, no two engineers can possibly be bidding on furnishing the same amount and quality of professional service. In such cases, the public body inviting the bids receives differing bids on differing services. The amounts bid in dollars can be tabulated but there is no way the amount and quality of the professional service to be rendered can be compared. In most cases, the public body, having asked for competitive bids, accepts the low bid. That is what the public official was after when he advertised in the first place, and that is what he gets.

A little reflection on the part of any public official should convince him that it is not in the public interest, nor is it required by law, to secure needed outside professional services under competitive bidding procedures. The conscientious and prudent public official is likely to discuss an important project with one or more engineering firms before making a final selection. A final selection should be based on such considerations as prior experience and magnitude of work similar to that in hand, qualifications and experience of the principals of the firm and the key men proposed to handle the work, demonstrated accuracy in predetermining construction costs, availability considering sufficiency of personnel and work already current with the firm, standing of the firm with investment houses and bankers, and finally, the estimated cost of the professional service to be rendered.

The official's engineers can determine whether the price named is reasonable, and too low a price should be a cause for rejection. It is bad business to award an engineering contract at a figure so low that the engineer may not be able to afford to produce satisfactory work. There may be waste costing several times the amount of the engineer's fee, or the construction may be shoddy or even dangerously unsafe. Not all engineers, nor anybody else for that matter, can be depended upon to produce satisfactory work at a loss—the temptation is to spend $1,000 of the client's money to save $10 of one's own. Cheap engineering is expensive and to employ it is stupid.

Some public officials erroneously believe, or claim to believe, that public works laws and ordinances requiring competitive bidding on public work generally apply equally to engineering contracts for furnishing professional services for such projects. The fact is that there is no legal compulsion to procure professional services by advertising and awarding contracts on the basis of the low bid. This is never done for legal services, and that the same applies to other professions, the engineering profession in particular, has been upheld again and again in the courts. Attention is directed to a comprehensive review of court decisions made by William N. Carey, Executive Secretary, ASCE, in the May 1954 issue of CIVIL ENGINEERING. A typical opinion in law is quoted from that review:

> "Provisions as to competitive bidding have been held *not* to apply to contracts for personal services depending upon the peculiar skill or ability of the individual, such as the services of . . . an attorney at law, a superintendent or architect . . . or a consulting and supervising engineer, and generally the requirement does not apply to the employment of a professional man, in which case the authorities have a discretion as to his qualifications."

Recently the Board of Direction took disciplinary action in a case involving violation of the Code of Ethics with respect to competitive bidding on a price basis. Here the issue was drawn so sharply that it implied defiance—a challenge which was resolutely met. Other cases may come before us where the issue will not be so clearly defined. It is encouraging to know that the Committee on Professional Practice has been charged with the task of developing a clear definition of competitive bidding on a price basis. On border-line questions in this category such a definition will be most helpful.

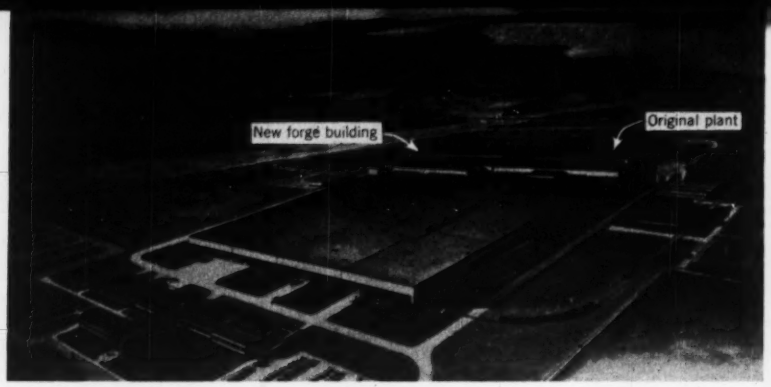
Competition among engineers has been active and, in most cases, healthy and proper. ASCE is not against such competition. It is against the unprofessional practice, admittedly rare, of competition solely on a price basis by engineers to secure professional engagements. This principle is one of the prime fundamentals of our concept of engineering as a profession. May we ever defend it!

The Code of Ethics of the ASCE as it now stands is the result of over a century of tested experience. It is designed to protect the profession from the unscrupulous, and the public from the avaricious. Every engineer agrees to abide by it when he becomes a member. In many respects our profession is one of the noblest. To keep it so we must strive to expose those who have not earned the honored name of "engineer", we must continue our rigorous requirements for admission into the Society, and we must maintain and enforce our high ethical standards, meanwhile expanding by every possible means the knowledge gained by our experience, our contributions to science, and our usefulness to society.

JAMES R. KELSEY, M. ASCE
Senior Structural Engineer

FREDERICK T. COMSTOCK, Jr.
J. M. ASCE
Concrete and Steel Designer

Anderson-Nichols & Company, Concord, N. H.



Plant of Wyman-Gordon Co. at North Grafton, Mass., was expanded in heavy-press program of Air Force.

Heavy building and crane loads carried by 100-ft K-trusses

Required to house two forging presses of unprecedented size, the new forge building in the Wyman-Gordon Company plant expansion program presented difficult design and construction problems. The 100-ft K-trusses finally adopted to carry both crane and building loads are not of record size, but are somewhat unusual in their makeup.

The Wyman-Gordon Company's plant expansion program marked the initial phase in the heavy-press program of the Air Force, brought about by the technological developments of World War II and hastened by material requirements of the Korean conflict. The two record-size forging presses which the new plant was designed to house weigh 35,000 and 50,000 tons respectively. The two new interconnected buildings comprise over 16 acres of floor space and provide for all the multitudinous operations and equipment essential to a complete forging process.

Of the many salient features involved in this project, only the analysis of the 100-ft crane and building truss in the new forge building will be treated here.

Construction difficulties in the forge building all centered about the giant presses. At the time the plans for the structural frame had to be completed, there was still uncertainty as to press dimensions, press locations, operating clearances, and auxiliary equipment and arrangement. These uncertainties influenced Wyman-Gordon's project engineers to insist on a minimum of 100-ft 0-in. column spacing at the presses. Traversing this span are tandem cranes with a combined capacity of 350 tons.

Other factors contributed to the difficulty of the problem. Cranes in the existing building had to be able to run into the new extension, thereby limiting the width of the supporting members for the 100-ft spans to that provided for the original 25-ft spans. Furthermore, one of the presses was to be located immediately adjacent to the west end of the present building, so that the corresponding 100-ft crane supporting span was backed up to the expansion joint naturally occurring at the junction of the old and new construction. This effectively prevented the use of cantilever action or continuity to aid in carrying loads past the presses.

Unusual truss design chosen

When the design first got under way, thinking followed the orthodox line, which would call for separate crane and roof supports. However, even with this separation, loads and span lengths indicated trusses rather than girders. The possibility of using twin trusses was ruled out as they would have had to be so close together, because of the controls established in the existing building, that field connections, if they could have been made at all, could only have been effected with bolts difficult to enter and turn up. Ultimately it was decided to span the press areas with single trusses functioning as combined crane and roof supports. Transverse building trusses supporting the low-level roof were in all cases 25 ft 0 in. center to center, and were used to provide the necessary lateral support.

The 100-ft trusses, although not of record magnitude, assumed a somewhat unusual makeup. Extremely heavy wheel concentrations carried directly by the stiffened web of a 12 BP 74 pile section, were transferred to the double-web trusses by diaphragms within the top chord, spaced slightly more than 4 ft 0 in. center to center. Necessarily the top chord was subjected to bending as well as direct loads, and it became desirable to make the truss panels as short as reasonably possible. The truss depth was to a large extent fixed by the structural connections that had to be made. These limitations on the panel length and depth, coupled with the necessity of reducing the size of the critical diagonal web members and their gusset plates, indicated a K-system of trussing which as noted above, is somewhat unusual for a span no greater than 100 ft.

Loads and design stresses

Loads on K-truss (see Section A-A, Fig. 1) were:

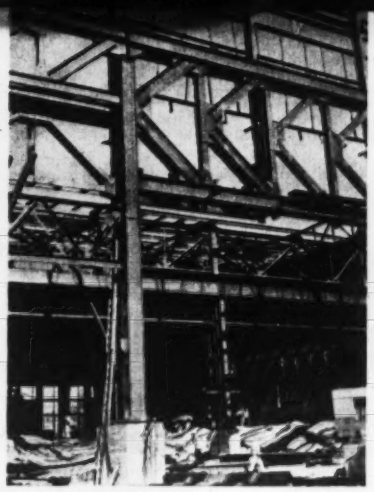
Dead load, 16 kips per panel point
Dead load + snow, 132 kips per quarter point
Pipe gallery, 5 kips per panel point
Dead load of crane girder, 4 kips per quarter point
Crane loads on top chord:
  Two 100-ton cranes with a total overload lifting capacity of 350 tons
  One 30-ton crane
Crane loads on bottom chord:
  One 20-ton crane
  One 10-ton crane

Maximum design stresses in K-truss members are:

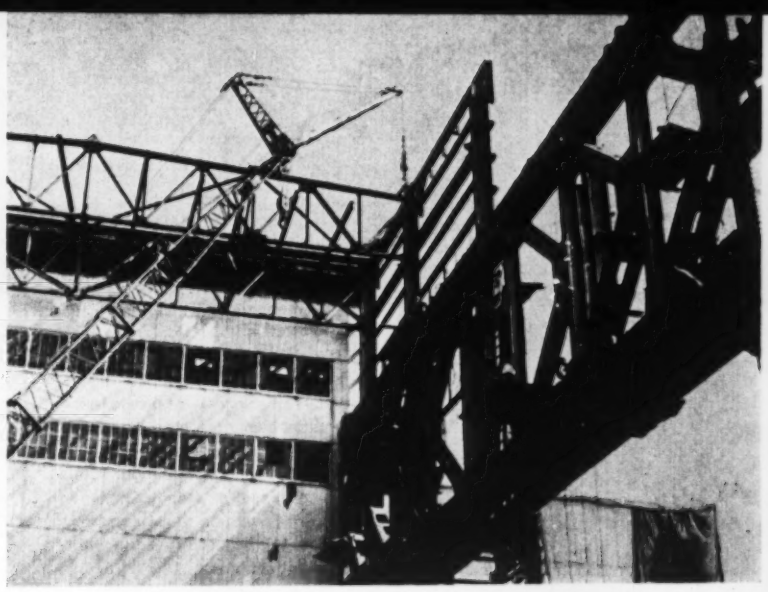
Top chord:
  Axial compression, 1,378 kips
  Local bending moment, 323 ft-kips
Bottom chord: 1,378 kips
End diagonals: 844 kips

Next came the problem of providing intermediate supports for the heavy lateral crane forces and the torsional moments caused by the eccentric loading of the upper columns and small cranes below (Fig. 2). This was solved by using a continuous web at the quarter points of the main carrying truss to transfer the moments into the low-level roof truss. The top and bottom chords of the trusses were attached to the web plates by tension ties, and the truss members were designed to withstand the additional stresses introduced by the resulting couple shown in Fig. 2 (*c*).

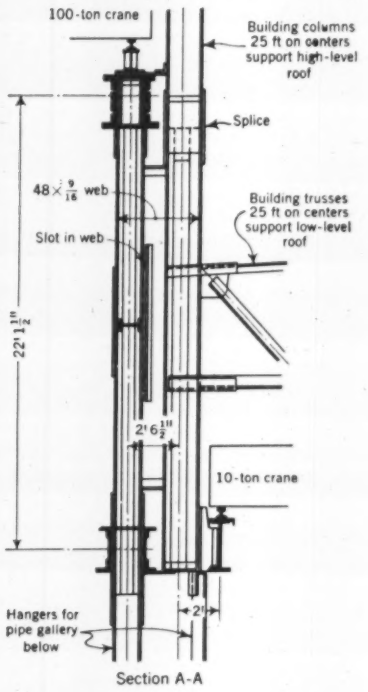
Building construction was completed in June 1954.

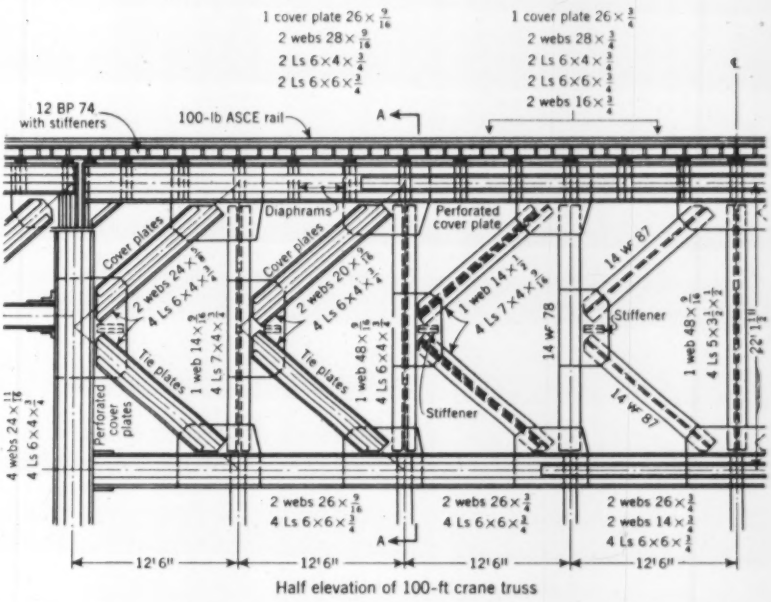


K-truss of 100-ft span carries transverse building trusses spaced 25 ft on centers. Supporting column and pier are at left. Finished floor grade is about 1½ ft above top of pier.



Crane erects high-level roof trusses eccentrically supported by 100-ft K-trusses. Wall of existing plant in background was later removed.

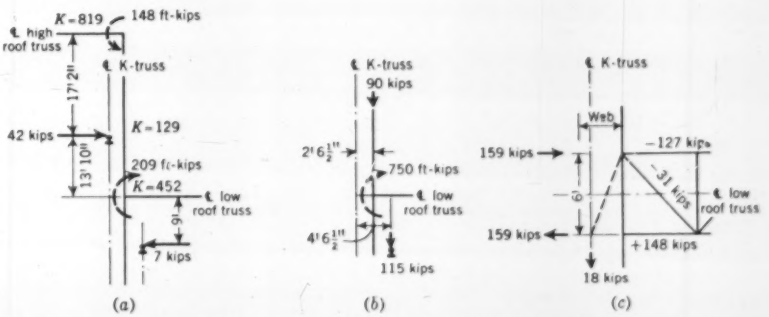




Half elevation of 100-ft crane truss

FIG. 1. K-truss 100 ft long carries tandem cranes with combined capacity of 350 tons, plus building loads.

The general contractor was the Gilbane Building Co. Design of the building and its foundations (exclusive of press foundations) was done by Anderson-Nichols & Co. A. H. Swift was Project Manager and Engineer for the Wyman-Gordon Co. The consultant for Anderson-Nichols & Co. was J. H. Minnich, A. M. ASCE.



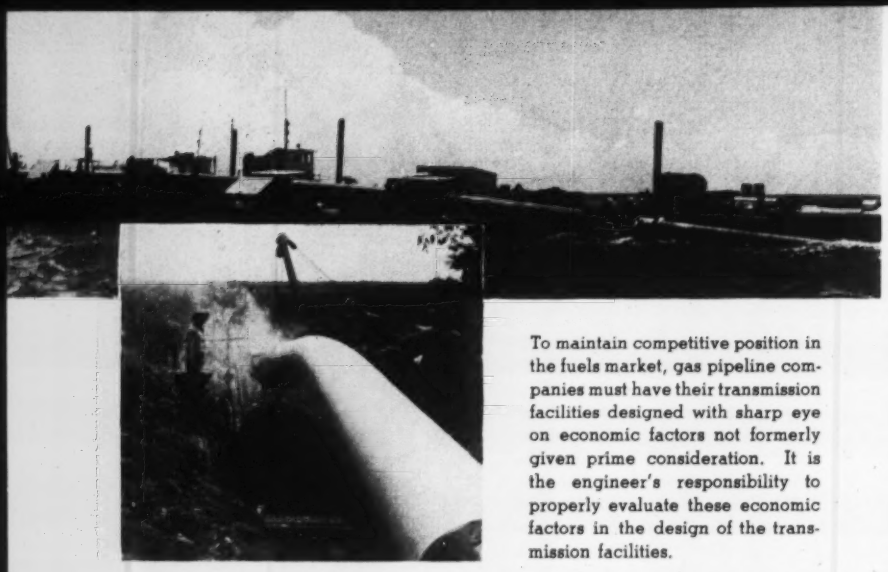
Resultant distributed moments from lateral crane forces

Resultant moment due to eccentric loading

Resultant couple and roof truss stresses, (a) + (b)

FIG. 2. Study of moments led to choice of continuous web at quarter points of main carrying truss to transfer moments into low-level roof truss.

Competition in gas pipe



To maintain competitive position in the fuels market, gas pipeline companies must have their transmission facilities designed with sharp eye on economic factors not formerly given prime consideration. It is the engineer's responsibility to properly evaluate these economic factors in the design of the transmission facilities.

The economics of natural gas transmission is each year becoming more competitive, not between pipeline companies primarily, but between natural gas and its competitive fuels—coal and oil. This situation is brought about by various factors, one of which is the rising field price of gas—20 cents per Mcf (thousand cubic feet) is no longer unusual. Other factors are increased steel prices, increased cost of right-of-way, tighter control by state authorities, and the approaching adoption of the much-needed revision of Section 8 of the ASA Code B31.1 for Pressure Piping.

In order to maintain a competitive position in the fuels market, the pipeline companies are increasingly faced with the necessity of designing their transmission facilities with a sharp eye on economic factors not heretofore given prime consideration. Basically, the economic factors affecting the engineering design of pipelines appear to be:

Market and load factor

1. The character of the market to be served, and the development of the load factor.

2. The availability and economics of gas storage facilities.

3. Determination of the economic balance between line size and ultimate installed horsepower.

4. An accurate early determination of the pipeline location.

The character of the market to be served establishes the load factor at which the pipeline will operate, except as this factor is increased by means of interruptible industrial sales, peak shaving by customer utility companies with manufactured or liquefied petroleum gas (butane-propane) facilities, or storage facilities located reasonably close to the market area.

The summation of the individual load classes for which there is a market demand establishes the character of the market to be served, which falls into eight distinct classifications, with a range in load factor as follows:

Character of Market	Load Factor, %
1. Residential general	75-85
2. Commercial general	75-85
3. Residential space heat	23-28
4. Commercial space heat	23-28
5. Small industrial	60-75
6. Large industrial, firm	60-75
7. Industrial interruptible	None
8. Company use and unaccounted for	70-75

TABLE I. Typical gas pipeline loads for service area of one million population

Class	No. of Customers	Consumption Factor	Deg.-Day Deficiency	Annual, MMcf‡	Load Factor, %	Max. Day, MMcf‡
Residential general	200,000	25 Mcf†	...	5,000	85	16
Commercial general	50,000	75 Mcf†	...	3,750	85	12
Residential space heat*	80,000	25 cf	7,000	14,000	27	142
Commercial space heat*	10,000	75 cf	7,000	5,250	27	53
Small industrial	200	...	...	6,000	70	23
Large industrial	10	...	...	2,000	70	8
Company use and loss	...	...	...	5,400	70	21
			Total	41,400		275

* Included in General Customers.
† Mcf = thousand cu ft.
‡ MMcf = million cu ft.

Combined load factor is:

$$\frac{41{,}400 \times 100}{365 \times 275} = 41.2 \text{ percent}$$

"Load factor" is the ratio of the average daily send-out to the maximum daily send-out, and is always less than unity.

A typical annual and maximum-day load for a service area of a million population might then run as shown in Table I for firm load requirements, where the area experiences a 7,000 degree-day deficiency. A load factor such as those listed, when imposed on a long-distance transmission line would be, generally speaking, economically infeasible, since the facilities would be operated on an annual basis at only 41.2 percent of the maximum-day capacity. The remedy might be found in one of the following three ways, or in a combination of them:

1. Interruptible industrial sales
2. Peak shaving
3. Natural-gas storage operations

For example, if as much as 45,000 MMcf (million cubic feet) of interruptible industrial gas can be sold annually—and this is almost entirely a question of price—the load factor to the pipeline becomes 86.1 percent, a fairly desirable situation. If, however, the interruptible sales could be increased to 58,600 MMcf annually, the load factor would approach 100 percent and the pipeline could be operated at design capacity each day of the year.

Peak shaving—that is, cutting down the peak demand on the pipeline—through the use of existing manufactured-gas equipment or liquified petroleum gas (propane or butane) facilities belonging to customer companies—while the least desirable method of increasing the pipeline load factor, does have some merit, especially during the early years of load growth after conversion to natural gas.

Value of natural-gas storage

Since the cost of owning and operating a natural-gas pipeline system is nearly a constant, whether all or only a part of its capacity is utilized, the cost of transporting gas on a unit-volume basis is almost inversely proportional to the load factor. It has been shown that large volumes of interruptible industrial sales—up to the 60 percent of the annual sales which are required for a 100-percent load factor—may be impossible.

brings economics to the fore

line transmission

WILLIAM B. POOR
Manager, Pipeline Construction
Ford, Bacon & Davis., Inc.
New York, N. Y.

Therefore, in an effort to obtain high-load-factor operation without interruptible sales, the gas industry has developed various types of storage facilities located at or near the market areas.

For five storage schemes, the generalized unit costs for investment per Mcf of storage capacity are as follows:

Type of Storage	Cost per Mcf of Storage Volume
1. Underground, in depleted gas formations or water-bearing sands	$0.40
2. Underground, in excavated caverns	0.50
3. Liquefaction	20.00
4. High-pressure bottles	50.00
5. Gas holders and spheres	$175-$250

Only underground storage is sufficiently low in cost to permit economic terminal storage in sufficient quantities to level annual load variations. Only storage in depleted natural-gas reservoirs and, to a limited extent, in water-bearing sands, has been used to date to store large volumes. Storage in excavated caverns theoretically offers promise where natural reservoirs are not available.

Storage fields now in operation have a combined capacity in excess of 1,200 billion cu ft and economically serve markets as remote as 300 or more miles. Where such storage fields are available, gas can be delivered into storage during the summer months instead of being sold as cheap interruptible fuel. Such a program enables the pipeline to operate at a high load factor, and preserves deliverability to meet the peak winter demands of space heating customers, thereby providing maximum utilization as a superior fuel.

Controllable design factors

The basic design factors over which the engineer has control are pipeline diameter, maximum operating pressure, pipe-wall thickness, compression ratio, and compressor-station spacing. For a given diameter and maximum operating pressure, the pipe-wall thickness is fixed by the provisions of the ASA Code for Pressure Piping and is further modified in some states by more stringent codes. Basically, therefore, the design factors are reduced to four, and the optimum design is obtained by the proper selection of these four, with the aim of holding the annual cost of owning and operating the pipeline system to a minimum.

Two basic procedures may be used for arriving at the best selection of the design factors to produce the minimum annual cost of service. One method is essentially cut and try through the use of a large number of calculations involving the application of various values for the several design factors to determine the best combination. The other method, which involves the use of calculus to determine the proper combination of design factors, is beyond the scope of this discussion.

An example of the use of these basic design factors may be of interest. A pipeline approximately 1,000 miles in length, capable of delivering 300 MMcf per day, may be designed either as a 24-in. pipeline operating at 1,000 psig, with compressor stations approximately 80 miles apart, or as a 30-in. pipeline operating at 800 psig, with compressor stations approximately 240 miles apart. Each of these pipelines will produce approximately the same cost of service. There are, however, vast economic differences between the two. The 24-in. line with a station spacing of some 80 miles has been powered to approximately its economic optimum, leaving little or no room for expansion in capacity. Its capital cost is less than that of the 30-in. line, but its cost of operation is somewhat more. The 30-in. pipeline, with a station spacing of some 240 miles, however, may be economically developed by additional compressor stations to a capacity of some 550 MMcf per day.

It may now be concluded that, within reasonable limits, the best use of a given size of pipeline is with a compressor station spacing of some 80 miles. For a given capacity, however, with any reasonable probability of increased market growth, a larger line, with a station spacing of 160 to 240 miles, is better, since it can be developed to greater capacity at a lower cost per Mcf of gas transported by the subsequent addition of intermediate compressor stations. The economic problem of evaluating load growth, therefore, becomes of real and vital interest to the engineer in determining the design factors.

It is hoped that the much-needed revision of Section 8 of the ASA Code B31.1 for Pressure Piping will be adopted before the end of the year. This code will govern the physical design of pipeline systems. The revised code provides for four Construction Types, each having its specific design factor, ranging from 0.72 to 0.40, as applied to the specified minimum yield strength of the pipe. In addition, four Class Locations, as related to exposure and population indexes, are prescribed. Each of the four Class Locations is related to its respective Construction Type.

For example, Class 1 location and Type A construction for a 30-in. 780-psig working-pressure pipeline, with a 52,000-psig minimum-yield steel, requires a pipe-wall thickness of 0.312 in., or 261.58 tons per mile. Should the class become "2" by reason of a changed physical location, the type becomes "B," requiring a pipe-wall thickness of 0.375 in., or 313.24 tons per mile, an increase of 20 percent in the steel required. Such a difficulty might be mitigated by changing the location of the pipeline in the field.

Engineer's responsibility

It is the writer's opinion that the proper evaluation of the economic factors affecting the design of a pipeline is basically the responsibility of the engineer. Extreme care and judgment must be exercised when designing pipeline systems in determining the character and magnitude of the market, in providing the optimum relationship between pipe size and compressor-station spacing, in interpreting the governing design and construction codes, and in physically locating the pipeline itself, so that the facilities will enjoy an economically competitive relationship with other fuels.

(This article has been prepared from the paper presented by Mr. Poor at the ASCE Annual Convention in New York, before a session sponsored by the Construction Division's Committee on Pipelines, Eldon V. Hunt, Chairman.)

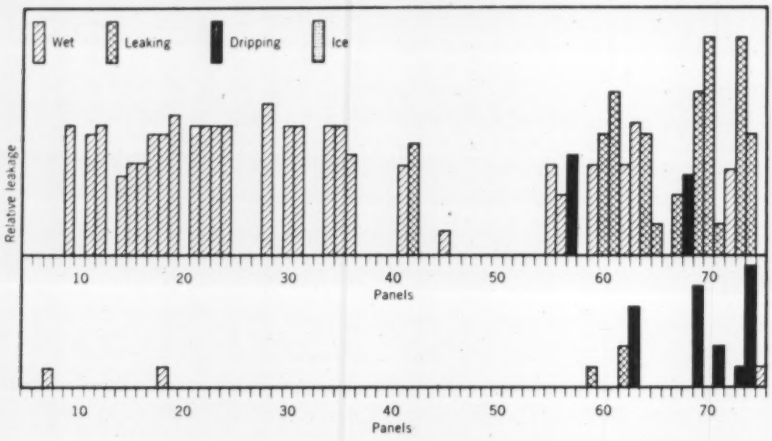


FIG. 1. Relative leakage through roof of Tuscarora Tunnel on Pennsylvania Turnpike before and after sealing by Lelite backfill and chemical solidification is shown by concrete panels into which lining was subdivided. Upper graph shows leakage before sealing, and lower graph, leakage after sealing.

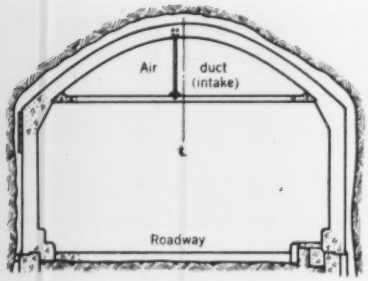


FIG. 2. Typical cross section of Tuscarora Tunnel on Pennsylvania Turnpike shows air duct along top of tunnel, which acts as intake. Exhaust is through vehicular passageway. Excessive leakage through roof of air duct restricted flow of air into tunnel when water froze in winter.

Chemical sealing stops leakage

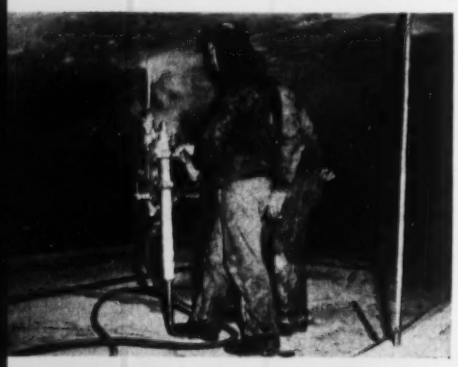
C. W. STICKLER, JR., President, and A. ALLAN, JR., Mining Engineer

Leakage of ground water through construction joints and cracks in the concrete linings of more than seven miles of tunnel on the Pennsylvania Turnpike caused engineers concern for a number of years. In addition to damage to the concrete caused by freezing of the water during the winter months, reduction of the cross-sectional area of the airway by the resulting ice formations frequently restricted the passage of ventilating air. Increasing the speed of the fans served mainly to reduce fan efficiency and to increase power costs. Dripping of this water from the top of the vehicular part of the tunnel onto vehicles passing beneath was a source of worry to the Turnpike Commission and of irritation to motorists.

Continuous search for a solution finally led Turnpike officials, early in 1950, to discuss the problem with the Manu-Mine Research and Development Co. of Reading, Pa., which had developed a chemical process for sealing soil or rock strata adjacent to underground openings. Arrangements were made to conduct an engineering survey of conditions in seven tunnels. This was to be followed by recommendations for stopping the leaks. Surveys were started in the latter part of 1951 and completed early in 1953. The results of this survey in Tuscarora Tunnel are shown in Fig. 1. Sealing work in this tunnel was started May 1, 1953, and completed in November of the same year.

The tunnels on the Pennsylvania Turnpike are each roughly a mile in length with a two-lane rectangular trafficway 28 ft wide by 14 ft 6 in. high. Above the roadway is a segmental-shaped air duct with a base of 24 ft and an altitude of 5 ft 6 in. at the center of the arc (Fig. 2). A concrete floor separates the air duct from the trafficway. Openings (vents) were constructed through this floor over each traffic lane at regular intervals throughout the length of the tunnel. A masonry bulkhead divides the air duct into two approximately equal lengths.

Ventilation is provided by two blower-type, centrifugal fans at each end of the tunnel. The total fan capacity varies from 370,000 to 622,000 cfm (cu ft per min), depending on the tunnel. Fresh air is forced from the air duct into the vehicular section (return airway) through the vents in the concrete floor of the air duct to dilute and sweep away harmful gases through the vehicular section. Reduction of the cross-sectional area of the air duct by ice forming



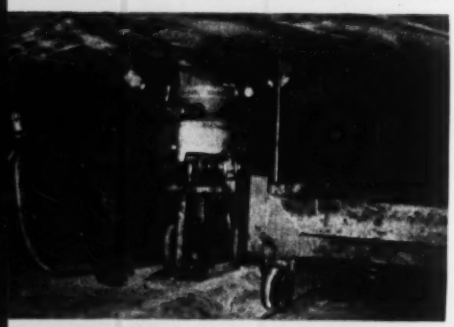
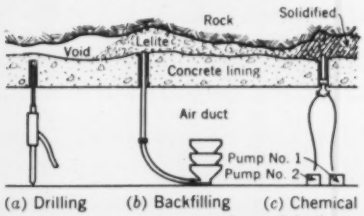
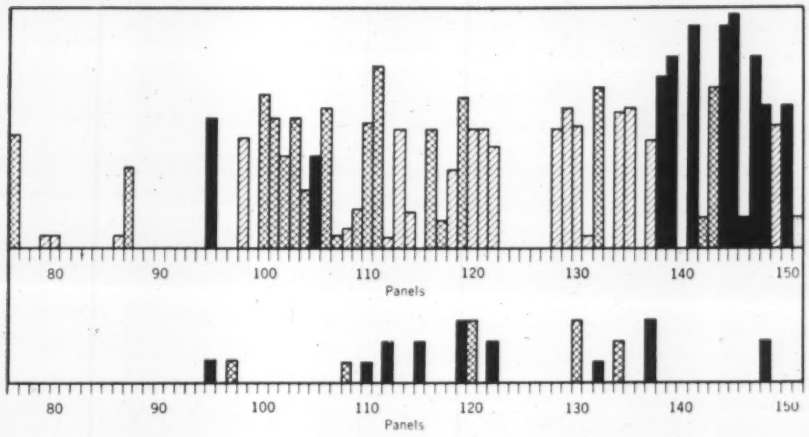


FIG. 3 (Below). Sequence of three main operations—drilling, backfilling, and sealing with chemicals—was simple and required crew of only 7 men. On Tuscarora Tunnel two crews of 7 men each were used, one at each end, working toward center. Photos show equivalent operations—drilling at top, backfilling in center, and dual-pump sealing operation at bottom.





in tunnels of Pennsylvania Turnpike

Manu-Mine Research & Development Co., Reading, Pa.

at any point forces greater quantities of air through the outside vents with correspondingly less air passing inside, where it is needed. Because the vehicular section serves as the return airway, where characteristically higher air temperatures are further raised by the hot exhaust gases from vehicles, ice formation there is not as serious as it is in the air duct. For this reason, sealing of the air-duct roof only was considered sufficient to eliminate the difficulty.

There was another unsafe condition which the engineers desired to remedy at the same time the sealing operations were carried out. This was the large void spaces which were present between the 16-in.-thick concrete lining over the air duct and the surrounding rock strata. These voids, up to 110 in. high, had been created during construction of the tunnel through the soft, friable rock formations found in this area. Frequently, as the face was advanced, large quantities of rock fell from the roof of the new tunnel or from the roof of the old tunnels.

These roof areas had been supported during construction, and after construction, timber sets had been erected for their support on the top surface of the concrete lining. After these supports had been in place 10 or 12 years under alternately wet and dry conditions, Turnpike officials considered their value questionable. They therefore decided to fill the voids with inert material, particularly those large voids which existed over relatively thin sections of tunnel lining. Since chemical sealing would require the drilling of holes through the tunnel lining, it was decided to combine the two processes. The chemicals would solidify the bottom layer of inert material used to fill the voids, and would provide a permanent, impervious layer over the concrete lining which could not be seriously affected by temperature changes and consequently would not develop cracks from repeated expansion and contraction.

Three operations involved

Equipment for this work falls into three main categories, that necessary for drilling, backfilling, and solidifying, plus miscellaneous items which serve all three of these operations (Fig. 3). Two complete sets of equipment were used, one on each end of the tunnel being sealed.

In Table I equipment items are listed according to their use on the project. The last item listed, the 2-in. steel pipe, was used to supply air from the compressors for operating drills, Bondactor machines, and chemical pumps. The line was installed throughout the length of the air duct, and a compressor connected at each end, so that the combined capacity of both compressors was available to the machines of each crew at all times. Tees, installed in this line when it was laid, permitted attachment of machines at regular intervals.

Work was done by two crews of 7 men each (one crew on each end of the tunnel), beginning at the portal and progressing toward the bulkhead in the center. The east crew sealed 2,572 lin ft of tunnel; the west crew, 2,721 lin ft.

Drilling—the first step

The work was divided into three phases which progressed simultaneously. The first step, drilling, was maintained far enough in advance of all other work to prevent delay in later operations. For this work, a stoper and a jackhammer with an air leg were operated by two men. Holes were drilled in patterns depending on the void space found above the concrete tunnel lining or the thickness and character of the concrete lining itself, as determined by test holes or by data from holes already drilled for sealing.

In areas where the voids were large, a pattern of six holes, evenly spaced in a line across the tunnel at right angles to the centerline, was used. Lines were spaced 6 to 8 ft apart along the centerline. Outside holes in each row were drilled at approximately 28 deg from the horizontal; the second hole from each side was drilled at 61 deg; the two inside holes were drilled at 90 deg. In wet sections where the voids were small, this pattern was reduced to 3 or 4 rows of holes per panel (9 to 12 ft apart) with a test hole midway between each row on alternate sides of the tunnel centerline. Where voids were small (1 to 3 in. high) and water leakage light or non-existent, a test pattern of 6 to 8 evenly spaced holes, staggered on each side of the tunnel centerline, was used. Where voids were small, panels dry on one side were drilled on the wet side only.

Junctions between wet and dry sections were drilled and sealed to isolate the wet area by means of a solidified barrier of chemical, to prevent water from moving into the dry section when it could no longer escape through the tunnel lining.

The thickness of the concrete lining and the height of the void space above it

TABLE I. Equipment used to seal tunnel

Drilling
- One jackhammer or stoper drill
- One air leg
- Three drill steels
- 50 ft of 1-in. air hose with 1¾ in. bits

Backfilling
- One Bondactor sandblast machine with hose and nozzle
- One ¾-ton transport cart, track-mounted
- One Lelite storage bin and discharge chute

Chemical placing
- Two 300-gal mixing tanks and mixers
- Two 55-gal transportation tanks with scales
- One motorized, track-mounted transport car
- Two 26-gpm, 200-psi, duplex compressed-air-operated pumps
- Two steel injectors with double valve tees
- 100 ft of 1-in. high-pressure air hose
- Four 1,900-gal storage tanks

Miscellaneous
- One 365-cfm diesel-powered air compressor
- One truck-mounted gasoline shovel, ¼ cu yd
- One 1,250-kw generator for lighting
- One 1½-ton flat-bed truck
- 5,293 ft of 2-in. steel pipe

were measured for each hole. From these data, Manu-Mine engineers were able to plot the extent of the voids and their capacity to hold backfill material. The character of the concrete was also noted throughout the length of the tunnel, and thin or honeycombed areas were completely backfilled and solidified. Running records were prepared from this information showing quantities of backfill material and chemical sealing material used in various sections of the tunnel. The material used for backfill was Lelite, a light-weight, expanded shale aggregate.

A total of 3,024 holes were drilled through the tunnel lining for backfilling and sealing 46,133 cu ft of voids. An unknown additional number of holes were drilled partially through the concrete to seal cracks and joints. Workmen injected 23,129 cu ft of Lelite through the holes to fill 50 percent of the voids and 28,334 gal of chemical solution to seal the Lelite and cracks in the lining.

Placing Lelite—the second step

The second step in the process was the placing of Lelite sand in the voids behind the concrete tunnel lining. The Lelite, which was stored in a 20-ton hopper on the surface over the tunnel portal, was loaded by gravity through a chute and manually operated gate into 3/4-ton track-mounted carts in the air duct and transported to the Bondactor machine for placing. This machine, operated by compressed air, has a rated capacity of 250 cu ft of material per hour. Lelite was placed by hand in the hopper of the machine and the nozzle on the discharge hose was inserted into a drill hole in the tunnel so that it projected slightly into the void space.

Where the voids were large, each drill hole was filled to refusal with Lelite. Because of the spacing of the holes and the method of injection of the Lelite, complete backfilling, except for the largest voids, was impossible, and actually was not sought. Rather the aim was to provide a layer of Lelite thick enough to prevent damage by falling rock to comparatively thin sections of tunnel lining. Voids less than 3 in. in height were not backfilled; chemicals were pumped into these spaces to form an impervious "skin" over the top surface of the concrete.

More complete filling of the voids could have been accomplished with a 90-deg elbow on the end of the discharge nozzle to direct the material into the voids, but this was not considered necessary. One man operated the machine while another transported Lelite to it and loaded the hopper. A third man, who held the discharge nozzle in place, was eliminated when a steel holder was built for this purpose.

Lelite for backfilling passes from 20-ton hopper on surface at tunnel portal, through chute by gravity, and into $\frac{3}{4}$-ton track-mounted cart for transport to backfilling machine (Bondactor).

Injecting chemicals—the third step

The third step was the injection of two chemical solutions to solidify the Lelite and fill the cracks and joints in the concrete. For this work two 26-gpm, compressed-air-operated, duplex, double-acting, piston-type pumps were used. One pump handled each chemical through a separate line. The two lines were united when they reached the injector so that the two solutions passed through the same opening in the injector. A quick-opening valve on each chemical hose at the connection to the injector controlled the flow and proportioned each solution.

This arrangement was possible only because of the shortness of the injectors, which permitted the combined solutions to reach the Lelite or the cracks before hardening started. Longer injectors would have been continually plugged by hardening of the solutions in the injector passageway. Manu-Mine has designed and built injectors for this purpose which permit passage of the two solutions simultaneously, but separately, for any required distance. The solutions are combined at the point of application in the rock or soil, thus obtaining maximum penetration and sealing effect.

Each of the two solutions was mixed in a special tank outside the tunnel and transported separately in 55-gal drums to the working areas as needed. Calibrated scales on each drum showed the quantity of chemical, in gallons, used in each drill hole. Experienced pump operators proportioned the quantity of each solution injected according to predetermined relationships to obtain best results.

Two men operated the pumps. One man, the pump operator, was responsible for correct proportioning of the chemicals and operation of the pumps. The other placed and tightened the injectors, kept them clean, and maintained the supply of chemical. He also opened and closed the injector valves on orders from the pump operator to proportion each chemical solution and to prevent the chemical being pumped from being forced back into the other chemical hose.

Injectors were inserted so as to project slightly above the top surface of the concrete, allowing the solutions to form a thin, impervious, solidified blanket of Lelite adjacent to the concrete. To prevent loss of chemical, the rubber gasket on the injector was tightened in the drill hole before pumping was started. Full capacity of the pumps was used, the pump on chemical No. 1 was started first and run for a definite number of strokes, after which the valve on that line was closed and chemical No. 2 was pumped for a known number of strokes to obtain the proper proportion. The process was repeated until hardening of the two solutions raised the pump pressure close to the stalling range. At this point the injector was removed and inserted in a new drill hole. Pumps of larger capacity permit solidification of more than one hole at a time, but this was not believed necessary for the work involved.

Drill holes in cracks and joints in the concrete were spaced at 12- to 18-in. intervals and were drilled only about half way through. When the injectors were placed in these holes, pumping proceeded as described above, forcing the confined solutions into the openings or crevices, filling them, and making them impervious to water.

The effectiveness of the sealing process is evidenced by the leakage records given graphically in Fig. 1. Data obtained in the preliminary survey, before sealing was started, are presented in the upper graph. Leakage data obtained in December of 1953, after completion of the main sealing operations, are presented in the lower graph. The five panels found to be still leaking to any extent at that time were later sealed. These leaks resulted because the tunnel had to be sealed during a period of very light rainfall, when there was little water behind the lining. Many places which ordinarily permitted the passage of water were dry, and did not show up until water was again present. The panels marked wet or leaking in the lower graph are not serious enough to affect the passage of air in the tunnels. The number of panels showing evidence of water had been reduced from 90 to 24. The quantity of water in panels not completely sealed had been reduced considerably.

Inspection of old watermarks in the trafficway indicates that roughly 90 percent of the water has been stopped in this section. Although many of the leaks had no actual physical effect on vehicles or users of the Turnpike, it is believed that they created an uneasy feeling in many motorists as they passed through the tunnels.

(Vol. p. 724)

II. Sea water for concrete

The first article in this group of two by Mr. Narver, dealing with the use of coral for concrete aggregate, appeared in the October 1954 issue. Mr. Narver reports the results of experience with the Atomic Energy Commission on construction on Pacific atolls, where rock aggregate and fresh water for concrete are obtainable only at great cost.

D. LEE NARVER, M. ASCE

Holmes & Narver, Inc.

Engineers-Constructors

Los Angeles, Calif.

Good concrete made with coral and sea water

No special cement is required to obtain satisfactory concrete when coral aggregates and sea water are employed. In all construction to date, which includes structures with walls up to 8 ft in thickness, standard portland cement conforming to ASTM C-150-49, Type I, has been used. Because of the high ambient temperature and the accelerating effect of the sea water used for mixing, a rapid set is obtained which can become a serious problem on large, continuous pours. However, with all equipment in good working order and an efficient crew, no difficulty has been encountered.

When new lots of cement are received, a set of standard 6 × 12-in. control cylinders is made using a mix of known compressive strength. It has been found essential to evaluate the quality of various lots of cements received, as strengths have differed considerably.

Recommended ASTM aggregate gradations are based on aggregate of isometric proportions. Coral aggregates, both coarse and fine, produced by the jaw-type crusher plants used, are typically angular and elongated, with the largest dimension two to four times the least dimension. All gradations of crushed coral aggregate manufactured are similar in shape. The fines passing the No. 50 screen, if placed under a magnifying glass, will show the same angular shape.

Angular coarse aggregates require higher percentages of sand for workability, and angular manufactured sands require additional water and cement. This fact and the fact that an additional amount of cement is needed to correct a deficiency in the fine aggregate gradation is responsible for the relatively high cement factors employed.

The next step is the determination of the percentage of fine aggregates for each site. Each site is tested to obtain the lowest percentage of fines that is workable. The 45 percent used as the minimum trial, in all cases created too harsh a mix. The percentage of fines used for the islands illustrated in Fig. 2 [October 1954 issue, page 42] ran from 46 to 49 percent.

The next item to determine is the designed slump. Experience from many pours has definitely proved that, with a well-designed mix, a 3-in. slump is workable for all classes of placement required. A coral concrete with a 3-in. slump quite often does not look workable, and construction men who have had little experience with coral aggregate usually object during placement and desire a greater slump, say $4\frac{1}{2}$ or $5\frac{1}{2}$ in. After a few months of experience with corals, these same men prefer a drier mix with a $2\frac{1}{2}$- to 3-in. slump.

Water control is a most difficult problem. With showers and heavy rains often a daily occurrence, with wide variations in the moisture content of stockpiled materials, and the ever-present possibility of human error, it is well to determine the maximum slump that will be acceptable. With a designed slump of 3 in., a $4\frac{1}{2}$-in. slump shows a minor reduction in strength and should be acceptable. A $5\frac{1}{2}$-in. slump will show reductions in compressive strength up to 25 percent, and a $6\frac{1}{2}$-in. slump up to 50 percent.

It has been our practice, in the interest of economy, to determine, for a basic 2,500-psi mix, the maximum water-cement ratio applying to the aggregate produced at each site. This has averaged between 0.55 and 0.60 for a 3-in. design slump. A basic cement factor is thus established, which is increased as necessary to obtain mixes of higher strength, at the same time decreasing the water-cement ratio as much as possible within the limits of workability.

Our experience indicates that more consistent results are obtained in adjusting established mixes to individual site conditions on the basis of the cement content, than on the basis of the normal water-cement ratio. Since water control is difficult, it is best to determine the amount of water to be used per cubic yard by trial based on designed slump.

With this method, it is advisable to establish as early as possible a yardstick or some standard of comparison. Such a yardstick is shown in Fig. 3. New lots of cement or aggregates from new sites may be substituted in these standard mixes for a quick, rough comparison. The effects of $2\frac{1}{2}$- and $4\frac{1}{2}$-in. slumps in comparison with the designed 3-in. slump are noted purposely to show how critical can be the water content.

ASTM Specification C-127-42, for determination of the specific gravity and absorption of sand and gravel up to $1\frac{1}{2}$ in. in size, gives three types of specific gravity—apparent, saturated and bulk. "Saturated surface-dry" is used throughout this report. A comparison of these three types of specific gravity for island No. 4 [Fig. 1, page 41, October issue] follows:

Weight of sample is 704 grams.

"A" weight of oven-dry sample in air is 796 grams.

"B" weight of saturated surface-dry sample in air is 703 grams.

Pycnometer plus water equals 1,430 grams.

Pycnometer plus water plus sample equals 1,868 grams.

"C" weight of saturated sample in water is 1,868 − 1,430, or 438 grams.

$$\text{Apparent specific gravity} = \frac{696}{696 - 438}$$

or 2.70 percent

$$\text{Saturated surface dry} = \frac{703}{703 - 438}$$

or 2.64 percent

$$\text{Bulk specific gravity} = \frac{696}{703 - 438}$$

or 2.63 percent

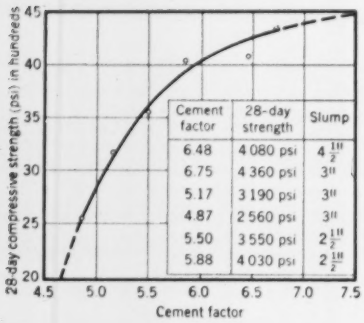


FIG. 3. Standard test mixes are used for quick determination of effect of new cement shipments and aggregates from other sites.

A

Typical broken cylinders made with sea water and coral aggregate show how such aggregate breaks. (A) Three-day-old cylinder, ruptured at 2,700 psi, shows typical shear planes. (B) Cylinder 7 days old, using island No. 7 aggregate, broke at 3,430 psi, with aggregate shear of less than 10 percent. (C) Cylinder from same mix as B, at age of 28 days, broke at 4,527 psi, with typical shear of 95 percent of aggregate.

In designing the mix, with the criteria determined as noted above, the values for aggregate quantities are calculated from absolute volumes, and the saturated surface-dry specific gravities are used in these calculations.

A typical example of the physical properties for coral stockpiles is detailed below. In this example 30 percent of the rocks put into the crusher became fine aggregate, 70 percent became coarse aggregate. This 30 percent is a very high percentage; the average was 25 percent, and 20 percent is low. Even with 30 percent, this amount was insufficient in quantity so it was blended with pit and beach sand. This blending results in lower values for the fines, as noted below:

Specific gravity, saturated surface dry:
Fines, 2.58
Coarse, 2.65

Unit weight, oven-dried, air-cooled:
Fines loose, 88.7 lb per cu ft
Fines rodded, 98.8 lb per cu ft
Coarse loose, 80.3 lb per cu ft
Coarse rodded, 91.0 lb per cu ft

Voids, oven-dried, air-cooled:
Fines loose, 44.9 percent
Fines rodded, 38.7 percent
Coarse loose, 48.2 percent
Coarse rodded, 41.3 percent

24-hour absorption:
Fines, 6.6 percent
Coarse 3.70 percent

In designing by absolute volume, 39 gal of water per cu yd is assumed for a 3-in. slump. This must be corrected for absorption and free moisture. Likewise the weight and volume of the absorption moisture must be added.

With the procedures and calculations completed, actual trial batches are then weighed, measured, and mixed in the laboratory mixer. Slump is carefully checked, and laboratory test cylinders are cast and stored in an outdoor freshwater bath until tested to destruction.

Bleeding tests are made on all design mixes but the percentage of bleeding normally is negligible. With a high slump the bleeding will be noticeable, but even in these cases no ill effects have been noticed.

During the breaking of the concrete cylinders, a well-designed coral-aggregate concrete develops a definite aggregate-shear pattern for the 28-day tests. This pattern is:

Cylinder Strength	Average Shearing of Aggregate
3,000-3,500 psi	80 percent
3,500-4,000 psi	85 percent
4,000-4,500 psi	90 percent
4,500-5,000 psi	95 percent
Over 5,000 psi	100 percent

Two diagonal breaks sometimes appear at rupture. These diagonals will often intersect each other and appear to result in a conical break. The 3-, 7-, and 14-day cylinder breaks appear to have no definite pattern and develop little if any aggregate shear regardless of their breaking strength. Typical ruptures are shown in the accompanying photographs.

Field control

When the design mix is finally approved and goes into production, slump tests and test cylinders are made daily. Screen analyses and moisture-content

B

C

determinations are made of the aggregate stockpiles before every major pour. Batch weights are adjusted for the fines which are included with the coarse aggregate, and the amount of mixing water is compensated for variations in aggregate moisture.

Cylinder samples are taken on every pour, three cylinders being taken for each 100 cu yd or fraction thereof. One of these cylinders is tested at 7 days, and the remaining two are broken at 28 days. On roof slabs and beam pours, four cylinders are taken, and the forms are not removed until the cylinder breaks indicate that 70 percent of the design strength has been developed.

Where field conditions are not known, as for example when there is a new site or new personnel, an ample factor of safety is included in the design. If a 3,200-psi concrete is required, the mix furnished for construction should be for about a 3,600-psi concrete. As field conditions warrant it, adjustments are made. Approximately 80 percent of the adjustments made are because of the construction personnel factor and the extent of experience with coral aggregates.

Use of sea water

Sea water has been used for mixing concrete when fresh or brackish water was not obtainable. At most sites, the only economic solution is the use of sea water. Few data are available on the durability of reinforced coral-aggregate concrete using sea water for mixing. We have demolished several reinforced structures from five to seven years old, which were built by the Navy's Sea-Bees as emergency structures and in which sea water was used. The concrete appeared to have been made with bank-run aggregates having an excess of sand and was not truly representative of a well-designed coral concrete. In most cases, the demolished structures appeared to be in excellent condition and the reinforcing steel clean. There were a few cases where the reinforcing steel was corroded. This corrosion was probably due to faulty design, placement, and porosity; it is believed to have been caused by external moisture, not by internal moisture due to the use of sea water in the mix.

A series of tests is being made comparing the use of salt and fresh water in mixes. Preliminary results are shown in Fig. 4. It will be noted that these results show two things: (1) higher early strengths of the sea-water concrete up to 17 percent over fresh-water concrete; and (2) lower long-time strengths,

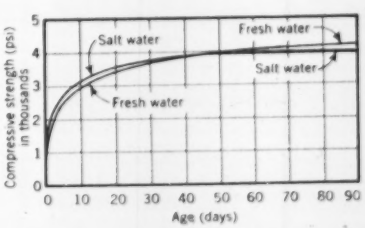


FIG. 4. Comparative strengths of coral aggregate concretes made with fresh water and sea water are being determined by tests now under way. Partial results are shown.

about 6 percent lower at the end of a 90-day period. The 90-day results represent breaks on a total of ten cylinders. These tests will be continued for 18 months.

Sea water does not appear to produce any undesirable physical or chemical effects. The somewhat accelerated development of strength is often an advantage, and in any case represents no greater disadvantage than the unavoidable acceleration due to the higher ambient temperatures. The slight decrease in final strength can be compensated for more economically by the use of slightly more cement than by the use of expensive distilled water. For a designed concrete with good aggregate no increase of weather protection is required. With coral aggregates of low specific gravity and high absorption, it is desirable to increase the protection to $1^1/_2$ in. if the exterior surfaces are not painted or treated. This is not due to the use of salt water, but probably to the absorption of rain.

Effect of temperature

The mean monthly temperatures on most tropical atolls are remarkably constant over a period of years. Likewise, the temperature changes are minor. The yearly patterns are constant. In the Marshall Islands the temperature is lowest in January and February, and climbs 1 deg per month until a maximum is reached between July and October. From October to January the temperature drops 2 deg per month (see Fig. 5). A review of many previous test cylinders broken indicates that despite climatic constancy, there is a surprising correlation between the 7- to 28-day strength ratio and the calendar date. For example, referring to Fig. 5: in August the 7-day strength will be 80 percent of the 28-day strength; in September it will be 82 percent. The data available are only for the months shown in this figure. Within that period, the relationship is a straight-line curve, and on this basis the other months may be approximated. A few hundred tests indicated a similar relationship for the 3-day strength. The 3-day tests are very recent and only the few months that are available are noted. The 3-day curve when fully developed will probably not be a straight line.

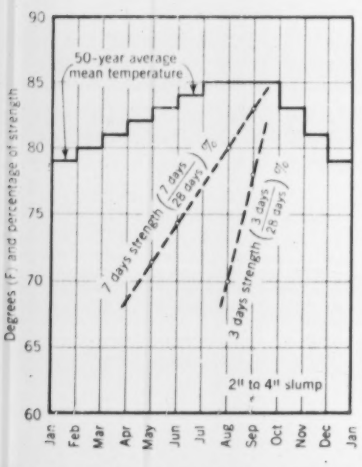


FIG. 5. Effect of temperature on curing rate is shown for a few available months. Complete curves, when further test results are available, probably will not be a straight line.

It should be noted that these curves apply only to slumps in the 2- and 4-in. range. As the slump increases to 6 or 7 in., the 28-day strength is reduced accordingly, but the 3- and 7-day strengths are even more reduced or retarded. Their percentages vary to such an extent as to preclude the use of Fig. 5.

During the months of high temperature, a relatively low humidity of from 50 to 60 percent is experienced. This results in fast setting, which may be a serious problem on continuous pours of 200 cu yd or more. Care must be exercised to have all equipment in good working order to reduce the chances of work stoppages due to breakdowns. A trained, efficient crew of operators is likewise required.

Curing

Most specifications require that concrete be cured for at least 7 days by one of the following methods: (1) covering with wet earth or sand, (2) using an approved membrane, or (3) sprinkling of the exposed surface.

For slabs and foundation work, we do not cover with wet sand or earth. In some cases we have built dikes and flooded the work with salt water. But in most cases, including foundations, slabs and superstructure work, all exposed surfaces have been cured by spraying on a liquid membrane. The use of a liquid membrane has proved to be more economical than sprinkling the exposed surfaces with salt water.

A total of 18 cylinders was tested to determine roughly the effectiveness of the commercial membrane product we were using. The results were as follows:

Method of Processing	3-Day psi	7-Day psi	28-Day psi
Open air and weather	3,307	3,990	3,952
Water-bath cured	3,315	4,023	4,428
Membrane cured	3,146	3,974	4,509

Normally the samples cured by open air and weather would have been subject to showers, rains, and high humidity. For the duration of these tests, however, there were no rains and only light showers about every 48 hours, the relative humidity going as low as 60 percent. These samples should therefore represent the lowest probable values for open air and weather.

Any membrane process, regardless of its value for "stone" concrete, should be tested for its effectiveness with "coral" concretes.

Admixtures

A limited amount of testing has been done on fly ash as an admixture and on certain air-entraining agents. The air-entrainment tests confirmed conclusions reached in other experiments with air-entrained concrete, namely, that in the case of rich cement mixes ($5^1/_2$ to $6^1/_2$ sacks of cement per cu yd) air entrainment does not improve workability and tends to reduce the compressive strength.

A series of tests was conducted to determine what value, if any, resulted from the inclusion of a fly ash in coral concrete. Various cement factors were used with varying amounts of fly ash. With slumps of from $1^3/_4$ to 2 in., these mixes proved to be the most workable ones we have produced with coral concrete. There was a general uniformity of breaks, and the compression strengths were increased. Bleeding was increased but not to such an extent as to prohibit the use of fly ash. By including a minor amount of an air-entraining agent, the bleeding was reduced to a negligible amount with only a very minor decrease in strength. Insufficient data have so far been obtained to warrant introducing such an element into our mix design.

In conclusion, Holmes & Narver wishes to acknowledge the encouragement and interest shown by the officials of the Atomic Energy Commission at the Pacific Proving Ground. The experimentation and research work, plus the actual field construction which confirmed the experimental work, represented an example of teamwork by a large number of our staff. Dr. Harry S. Ladd of the U. S. Geological Survey has added appreciably to the knowledge of the various organisms that exist on a tropical atoll. The Materials Testing Laboratory of the U. S. Navy at Pearl Harbor has likewise contributed useful and scientific data on coral. Many of its results and findings have been used during the development of the information reported in these two articles. It is also a pleasure to acknowledge the courtesy and helpfulness of the staff of the Portland Cement Association in Los Angeles. The photographs were taken by, and released through the courtesy of, the Atomic Energy Commission.

The young engineer looks at his economic position

Observations and conclusions of the Salary Committee, Junior Forum, Los Angeles Section, ASCE

William J. Carroll, *Chairman*
Hodge Gaines, *Secretary*
Philip Abrams
Dewain Butler William Keener
Harold Halldin Hugh Mulholland

A householder went out early in the morning to hire laborers for his vineyard. After agreeing with the laborers for a penny a day, he sent them into his vineyard. And going out about the third hour he saw others standing idle in the market place; and to them he said, "You go into the vineyard, too, and whatever is right I will give you." So they went. Going out again about the sixth hour and the ninth hour he did the same. And about the eleventh hour he went out and found others standing, and he said to them, "Why do you stand here idle all day?" They said to him, "Because no one has hired us." He said to them, "You go into the vineyard, too!" And when evening came, the owner of the vineyard said to his steward, "Call the laborers and pay them their wages, beginning with the last up to the first." And when those hired about the eleventh hour came, each of them received a penny. Now when the first came, they thought they would receive more; but each of them also received a penny. And on receiving it, they grumbled at the householder, saying, "These last worked only one hour and you have made them equal to us who have borne the burden of the day and the scorching heat." But he replied to one of them, "Friend, I am doing you no wrong; did you not agree with me of a penny? Take what belongs to you and go; I choose to give to this last as I give to you. Am I not allowed to do what I choose with what belongs to me? Or do you begrudge my generosity?"

This story was taken from the Gospel of Saint Matthew, the 20th Chapter, the first to the sixteenth verse. It shows that wages have been of concern to mankind for a long period of time, and today this age-old problem is still with us. Today, however, this problem has become more complex than it was in the days of Saint Matthew. It is of importance to all of us whether we be laborers, craftsmen, or professional men.

Today the young engineer is vitally concerned with his relative professional and economic position. It is not implied that the older engineer did not have this same concern when he was young, or that he does not still have it. This is merely a statement of fact about the young engineer.

The importance which the young engineer attaches to each of these concerns varies considerably among individuals. Some engineers believe that the professional and the economic aspects are interrelated and equally important. Others believe that these two concerns are entirely unrelated and non-equitable and that to attempt to equate them would be not only foolish but impossible. Still others believe that there is only one independent variable here—the economic—and that the professional is merely a dependent function.

In all the discussions heard by the Salary Committee of the Los Angeles Junior Forum, and in all the papers the Committee members have read on this subject, one main theme appears over and over: "While the young engineer admires and desires professional status, he is equally desirous of a good monetary return." There is a fine point here that should be understood. Most young engineers greatly admire, and hence seek, professional status, with all its attendant intangible benefits. On the other hand there does not seem to be as great an admiration for economic security. However, because it is necessary to most, it is very strongly desired, and hence, admired or not, it is sought.

For several years the Junior Forum of the Los Angeles Section has been confronted with a number of rather direct questions and statements from young engineers. Most engineers have heard them before—such questions as: "Who is doing anything to better the economic position of the civil engineer?" "Who is doing anything to put the civil engineer economically on a par with the other professions?" And such statements as: "Why, I wouldn't join ASCE. All it is, is an employer-controlled group of engineers who do not want higher salaries. Why, the organization is dead on its feet." These are not fictitious questions and statements. They are very real and, whether justified or not, they are being asked and stated by younger engineers.

To get the facts and to help answer these questions, the Juniors of the Los Angeles Section organized a committee in October of 1953. The purpose was to attempt to find an answer to the question, "What can be done to better the economic position of the civil engineer without detracting from any professional status that he may now have in the community?"

This question, so simply stated, is not simply answered. The Committee believed that its function was to act as a fact-finding group and that the best approach to the basic problem was first to investigate and evaluate two questions of fact. These are:

1. What is the present-day *Relative* economic position of the civil engineer? Here *Relative* is spelled with a capital "R"; and
2. Regardless of his position, good or bad, what has been done to improve it?

The Committee believed that with factual answers to these two questions at hand, it would be better prepared to seek the answer to the basic question, "What can be done in the future to improve the civil engineer's economic position?"

Today the Committee can only present data concerning the two questions of fact. As yet, it has not formulated any definite answers to the basic question. There are ideas and opinions, and some of these will be listed later. But to offset the possible criticism that the Committee has only diversified opinions and no overall solution, it is emphasized that these ideas are not here postulated as overall solutions, or as shortcuts to any Utopia.

What is the relative economic position of the civil engineer?

In answering this first question, the committee looked only for facts, not opinions. It believed that most people in any kind of profession or trade think they are underpaid—even top management. So data were collected.

The Committee first gathered what salary data it could on the civil engineer. Then, because the comparison is always drawn between the civil engineer and the associated crafts, such as electricians, carpenters, plasterers, and so forth, it was believed that a graphic comparison of accumulated earnings would be the best way to show the relative incomes. This has been done in Fig. 1. Next, because the medical doctor is always presented as the epitome of the well-paid professional man, his relative economic position was plotted on the same diagram.

This diagram is a static present-day picture. It was assumed that the salary existing today for any specific year of experience will not change. The curve of accumulated earnings represents all the money a man earns in his lifetime, based on today's levels. As he reaches any specified year of experience, he accumulates the amount of money that is prevalent today for a man at that experience level. While this assumption is probably not correct, it does give

a relative picture and eliminates the impossible task of prognosticating salaries in the future. Second, no adjustment of the curves was made to take into account the variations in the value of money earned now in relation to that earned at a later date. Third, the picture portrayed is typical of Southern California rather than of the nation as a whole because the curves on the crafts and one of the civil engineer curves are strictly for the Southern California area. Fourth, all points plotted on the curves are median values rather than average values.

The individual curves in this figure also need explanation. The data used as a basis for the curves on the crafts (plasterer, electrician, carpenter) were obtained from the Associated General Contractors-American Federation of Labor-Southern California Master Labor Agreement of June 1953. This agreement covers both the basic trades and the subtrades. The apprentice period for each of these crafts also was taken into consideration, as will be noted by the rather flat slope at the beginning of each curve. Once the journeyman rate was reached, it was continued for the rest of the economic life of the individual concerned. No foremen's wages were considered. To adjust for time lost due to weather, sickness, holiday, and vacation, an investigation was made of several contractors' records, and it was decided that 30 working days a year would amply cover these factors.

Plotting the accumulated earnings of a typical civil engineer was more difficult. The difficulty came, of course, in trying to determine accurately just how his earnings varied with his years of experience. A number of salary surveys were available as basic data. However, most of these required certain approximations when it came to tying the salary and the year of experience together; hence not all of them could be used. And since those that were reliable varied among themselves, it was decided to plot three of them.

Three curves have been plotted for the civil engineer with each of the curves including a minus $4,000 at a point four years after graduation from high school. This $4,000, an annual expenditure of $1,000 a year, has been assumed to be a very conservative estimate of the cost of educating the engineer. It was determined by taking the average from two engineering schools in the Los Angeles area—the University of Southern California and the University of California at Los Angeles. The former is a private institution which has a tuition charge, and the latter is a state university. The three curves plotted for the engineer are:

1. Curve A, based on the Merchants and Manufacturers Association Salary Survey of the Los Angeles Area, June 1954. This curve is the only one available for the Los Angeles area that definitely compares an annual salary with the year of experience of the engineer. This curve covers 159 design and field civil engineers with degrees.

2. Curve B, based on Table VI of the Engineers Joint Council Survey of Professional Income of Engineers, 1953. This curve covers 65,169 engineers in industry. Civil engineers are undoubtedly a minority in this group.

3. Curve C, based on Table XVIII of the Engineers Joint Council Survey of 1953 which covers 3,892 engineers employed in civilian government. Civil engineers probably predominate in this group.

This study might have included a fourth curve, that based on the ASCE 1953 Survey of Salaries for Civil Engineering Positions. However, it was impossible to delineate the experience level (time interval) at which each of the nine ASCE grades would be reached, and hence this curve was not plotted.

The final curve in Fig. 1 is for the medical doctor. Considerable time was spent trying to separate fact from fiction for this curve. The curve finally plotted was based on the Seventh Medical Economics Survey of April 1952. This survey was conducted by a private publication for medical doctors, *Medical Economics*, and consisted of an analysis of a little over 5,000 returns, of which 4,268 were from independent physicians. The data plotted are net income before taxes and include eight years of college and medical school. A simplified bar graph, Fig. 2, illustrates the difference between medical doctors, civil engineers, and plasterers. The data for the plasterer and the medical doctor are taken directly from Fig. 1; those for the civil engineer are the average of Curves A, B, and C of Fig. 1.

In general, what answer do these curves give to the question, **"What is the relative economic position of the civil engineer?"** Although several interpretations are possible, it was the Committee's general conclusion that, although the civil engineer's curve could not be pinpointed but had to be considered as a band of values, the civil engineer is in a poor economic

FIG. 1. Accumulated earnings of the civil engineer (based on data from three sources, A, B, and C) are compared with those of the medical doctor, plasterer, electrician, carpenter, and laborer.

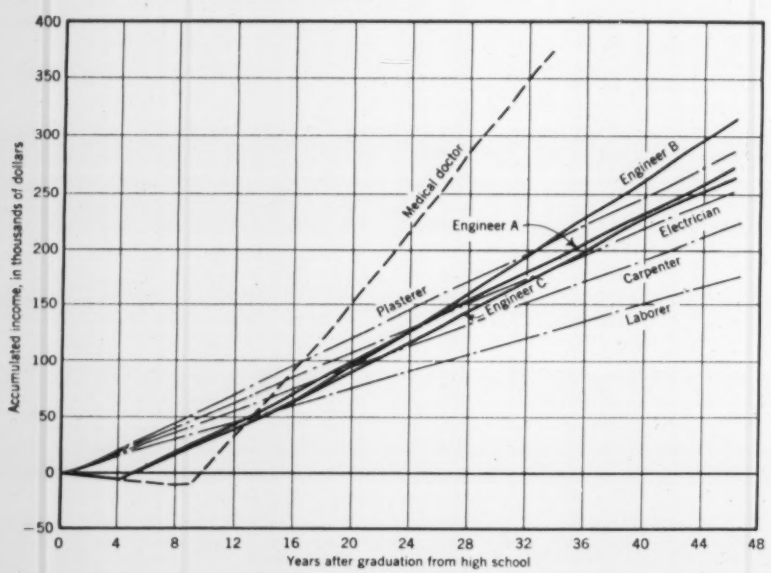
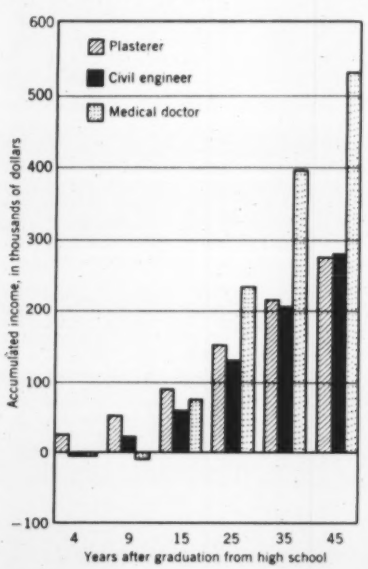


FIG. 2. Simplified bar graph compares accumulated income of plasterer, civil engineer, and medical doctor.



position relative to many of the crafts associated with his field and relative to another professional field such as medicine.

What is the answer to the second question, **"What has been done to better the economic position of the engineer?"** The approach to this question was much the same as that to the first. Data and facts, not opinions, were desired. The first step was to approach various members of the Society in Los Angeles who were, or had been, members of national and local committees, and ask them what had been done. The second step was to survey the literature and read what had been reported.

To tell in detail what was found out would take considerable space, but it can be briefly stated that the Committee was pleasantly surprised to discover the amount of activity that had taken place. The organizing of such groups as the American Association of Engineers in 1915, the American Engineering Council in 1920, the Engineer's Council for Professional Development in 1932, the National Society of Professional Engineers in 1934, the Joint Conference Committee in 1941, to become the Engineers Joint Council in 1945, are particularly commendable achievements by engineers, and show a decided interest evidenced by engineers in the past in improving their professional and economic status. And particularly gratifying to the Committee has been the leading role played by ASCE, especially when hampered by an obstacle so binding legally as its tax status. It has also been faced with the very tough hurdle of not having an adequate amount of money for the proper performance of many of its functions. The Committee now feels that it is in a position to disagree with some of the previously quoted statements made about ASCE. The Society is attempting to better the economic position of the civil engineer, and to elevate the civil engineer to the level of some of our better known professions, and in the minds of some engineers has already done so.

There is, however, the further question whether this activity has accomplished all that is desirable. To be sure, it has resulted in a considerable accomplishment, as witnessed by the professional provisions of the Taft-Hartley Act, by the exemption of professional engineers from wage stabilization, and by the formulation and recommendation of grade classification and salary schedules for professional employees. But has it yet accomplished its entire purpose? The answer appears to be "No." Look at Fig. 1. Look at Fig. 2. These curves lead the Committee to believe that much still remains to be done.

Hence we get back to our basic question, **"What can be done to better the economic position of the civil engineer without detracting from any professional status he may now have?"** This is the tough question. The engineer knows where he has been and where he is now. But where he is going and how he is going to get there are questions difficult to answer. "Collective Bargaining" and "Unity" are possible answers that space will not permit discussion of here. In this article, the answer cannot be given. However, the Committee would like to list just three of its lines of thought on the subject.

First, the Committee is thinking about a possible change in the tax status of the Society from Section 101 (6) of the Internal Revenue Code to some other category whereby no tax exemption would be enjoyed, but considerably more latitude would be possible in pursuing the professional and economic concerns of the engineer. Information received from National Headquarters tells us that such a change would require a dues increase up to fifteen dollars a year to pay the taxes resulting from the loss of tax exemption which would accompany this change of category. However, fifteen dollars a year is not much if it can be shown that the benefits derived from the change will greatly outweigh the added cost. We have been told also that the benefits would not outweigh the added cost. However, the Committee is not sure that this is the case, and believes it would be worth while to investigate what the Society might do for its membership relative to economic position, fees, collective bargaining, and increased publicity if such a step were taken. The Committee here proposes that such an investigation be undertaken by the Society.

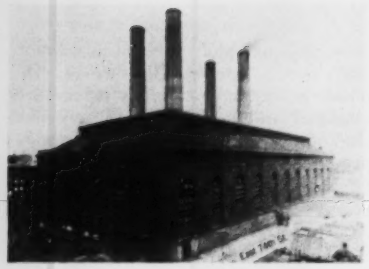
Second, the Committee is thinking about a possible reevaluation of the fee curves. It seems to us that all wages in the civil engineering field are based on these curves. The employer can only pay those salaries which will allow him to make a profit from his fee. In turn, public civil engineering organizations try to keep in step with salaries paid by private engineers. If the fees obtained for engineering services are to remain static, it is going to be difficult to raise the economic position of the engineer. It is believed by the Committee that a part of the blame for the poor relative economic position of the civil engineer can be placed at the doorstep of too low a fee charged by the employer to adequately compensate his employee. Of course, with changing prices of material and labor, and hence construction costs, the absolute amount of money received is changed and both the employee and the employer engineer are remunerated accordingly. However, the relative position of the engineer does not change and hence he remains in the same relative position shown in Fig. 2.

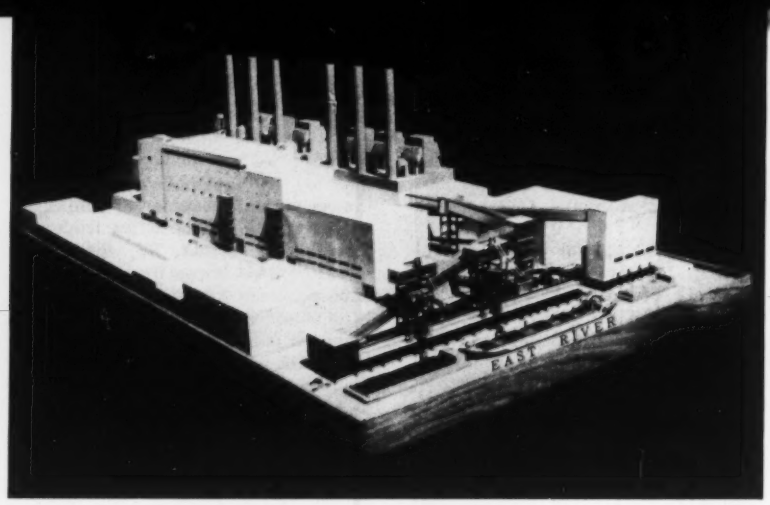
Third, the Committee is thinking along the line of stronger, more dynamic Local Sections. At present, in the Los Angeles Section, as well as in others, most of the activities are strictly on a donated-time basis. Publicity, the backbone of the program for educating the public as to the worth of the engineer, is an appointed, non-reimbursed position. As a consequence, perhaps the Local Section is not doing the job it should do. Possibly a permanent Local Section office with a permanent secretary, or a staff of some sort whose sole job would be to enhance the position of the civil engineer, would be the solution.

True, this takes more money, but it is possible that this increased cost would eventually result in a higher economic and professional position, which in turn would more than make up the increased cost. The medical doctor in Southern California pays $105 a year to his medical associations, of which $80 is kept locally for his state and county organization. The civil engineer in Southern California pays $5 a year to the Los Angeles Section. The plasterer? Well, he is not a professional man, but he pays $60 a year to his local.

In conclusion the Committee would like to refer once again to the Gospel of Saint Matthew. Very nearly the same problem exists now as existed in that remote period. We have young engineers coming into the field and making nearly as much as the older engineers who have borne the burden of the day and the scorching heat. We have engineers who feel that others around them are receiving more for contributing less. We have engineers who feel that they are not being treated generously. As a result, we know that one of the great problems confronting our profession today is the economic problem. Toward its solution we must orient our thinking and hope that what thinking and action we achieve will be constructive and successful.

(These observations and conclusions of the Los Angeles Section's Junior Forum Salary Committee were presented by Mr. Carroll, its Chairman, at the ASCE Annual Meeting in New York, before the Conditions of Practice Session, presided over by Finley B. Laverty, member, ASCE Committee on Junior Members.)





Outmoded central power station built in 1902, above, is being replaced with modern 60,000-kw plant shown in model. This article concerns first-stage construction only, estimated to cost $45 million.

Construction problems complicated by need for continuous power production

New York Transit Authority modernizes East 74th Street steam-electric plant

MARCEL P. AILLERY, M. ASCE, Chief Structural Engineer, The J. G. White Engineering Corporation, New York, N. Y.

Civil engineering problems of arrangement, design and construction rarely faced in the building of new steam-electric power stations were encountered in the first-stage modernization of the East 74th Street Power Plant of the New York City Transit System, a $45 million program. Since only minimum land expansion was possible, it was necessary to plan most of the work for construction in, over, and around a critically overloaded power plant. As the plant belongs to the New York City Transit Authority and provides power for part of the city's subway system, no shutdown or interruption to power production can be permitted.

In 1940 the City of New York acquired the privately owned Interborough Rapid Transit (IRT) and Brooklyn-Manhattan Transit (BMT) systems. Together with the Independent (IND) System built by the city in the 30's, these constitute the New York City Transit System. In 1953 this system, respresenting an investment of $1,800,000,000, was transferred from municipal operation to the New York City Transit Authority, a public benefit corporation.

View of old engine-room floor shows removal of antiquated engine generators in progress to make room for new turbine house and generating equipment.

The East 74th Street Power Plant is one of the three steam-electric stations (shown in Fig. 1) which are owned by the Authority and which generate power for the IRT and BMT Divisions. The others are the 59th Street Plant on the Hudson River in Manhattan and the Kent Avenue Plant on the East River in Brooklyn. They are not now interconnected. All are located where there is an adequate supply of water for condensing, and where coal can be delivered and ash removed by barge. All at present generate 25-cycle power only. The present power demand supplied by these three plants is 350,000 kw.

The IND Division is operated by 60-cycle power purchased from the Consolidated Edison Co. The Authority now generates 1,250,000,000 kwhr yearly and purchases 630,000,000 kwhr. All

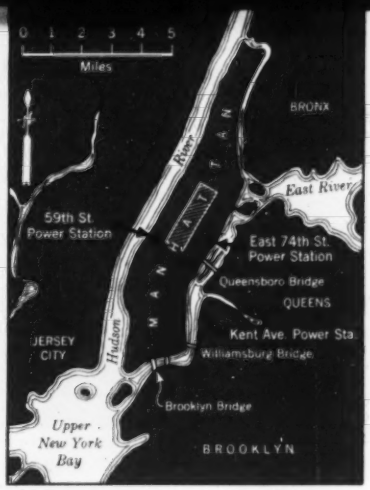


FIG. 1. Three steam-electric stations of New York City Transit Authority provide power for IRT and BMT Divisions of subway system. All three—East 74th Street Plant (here discussed), Kent Avenue Plant, and 59th Street Plant, are located on tidewater where plentiful supply of condensing water is available and where coal can be delivered, and ash removed, by barge.

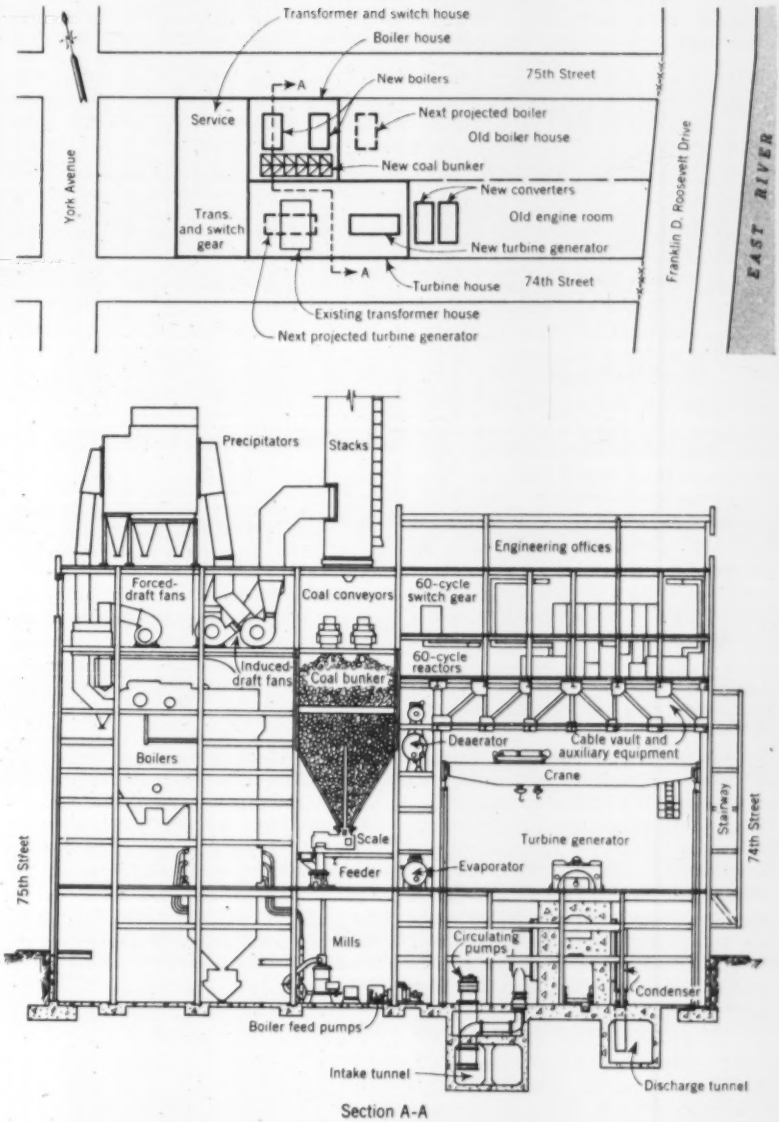


FIG. 2. Plan indicates how problem of locating new facilities on crowded site was solved so as to keep East 74th Street Plant in continuous operation. Left side of section A-A is through new Boiler House, right side through new Turbine House.

power is distributed from substation rotary converters or mercury-arc rectifiers to the railroad third rail at 600-volt direct current.

The broad program for modernization of the three Authority plants provides for the gradual replacement of obsolete equipment, the development of a single integrated power network, and changing over from 25-cycle to 60-cycle generation.

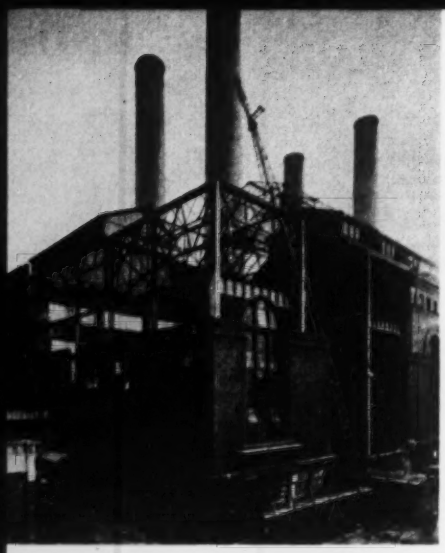
The property on which the 74th Street Plant is situated has been connected with the production of power since the earliest days of Dutch New Amsterdam, having been the site of a sawmill before 1639. The present plant began operation in 1902, and it was here and at the 59th Street Plant that power-plant history was made before 1920 in the development of theories and methods by which power generation was quadrupled (using the same boilers) and the amount of coal required per kilowatt-hour was cut in half.

Of the eight original reciprocating-engine generators in the 74th Street Plant, five were replaced with low-pressure turbine-generator units between 1914 and 1918—three of 30,000-kw capacity each and one of 60,000-kw capacity. It is the latter four units that must supply the power requirements of this station until the new 60,000-kw high-pressure unit now being installed goes into operation early in 1955. (The other three reciprocating-engine generators were removed to make way for the present program.) The second stage of modernization contemplates the addition of another 60,000-kw high-pressure unit. For the first stage, two 450,000-lb per hr boilers operating at a superheater outlet pressure of 1,350 psig and 955 deg F, will be required; and for the second stage, one more boiler of the same type and capacity. While coal is to be the primary fuel, either oil or natural gas can be substituted. The generator unit selected is known as the AIEE-ASME "Preferred Standard," rated at 60,000 kw when operating at 3,600 rpm and delivering 60-cycle current. Future stages of modernization will replace the original low-pressure turbine-generator units and the old, original boilers.

Contracts for first stage

First-stage construction at the 74th Street Plant, estimated to cost $45,000,000, is covered by 26 contracts, as follows:

1. Mechanical, $14,000,000, includes the two boilers and one generator already mentioned, relocation of piping and equipment, new insulation, fly-ash precipitators, vacuum ash system, belt and bucket conveyor equipment, and two coal-unloading towers.



Demolition of southwest corner of old powerhouse is seen under way, after eastern end of old engine room has been sealed off (at right) so that it can continue in operation. Old switch gallery and control room, which also must continue in operation, is protected by corrugated asbestos siding, observable just above top of partly demolished back wall. For later progress see views at lower corners of facing pages, in same general direction.

2. Electrical, $17,500,000, includes relocation of existing electrical equipment, two new frequency converters, all 60-cycle and 25-cycle switching equipment and auxiliaries.

3. Civil, $13,500,000, includes demolition of existing equipment and structures; excavation for and construction of foundations for new equipment and buildings; erection of steel, concrete, and masonry work; elevators, hoists, cranes, doors, windows, floor and roof coverings, partitions, painting, and furniture; plumbing, ventilation, air conditioning, and lighting; and subaqueous rock removal and the improvement of the waterfront bulkhead.

Many schemes were studied before a layout was evolved which satisfied all requirements of the present and future. This layout divides the structures into three specific areas or "houses," designated as the Boiler House, Turbine House, and Transformer and Switch House (Fig. 2).

The yard area west of the plant structure was completely filled with storehouses, sheds and shops, all having a vital function in the operation and maintenance of the power plant. These were all temporarily relocated in areas of the old plant that would not be disturbed by the construction program, by the addition of the necessary enclosures, bins, and racks. This relocation of services and provision of temporary facilities cleared all areas for the proposed construction except for the following basic obstacles:

1. The transformer house in the yard area (and future Turbine House), including track pits on each side, housing all transformers. This structure and its equipment will have to remain until new transformer cells are provided in the Transformer and Switch House and the new cable work completed. The transformers will then be moved individually in accordance with an established cut-over plan.

2. The underground turbine oil room in the yard area (and the future Turbine House), which can be demolished and removed only after the new turbine oil facilities are ready for operation in the Turbine House.

3. All 11- and 19-kv feeder cables from the plant to street manholes which traversed the yard area (and the future Boiler House) and prevented all rock excavation in the area of the new boilers. These feeder cables were removed after completion of all cut-overs to new cables between the plant and the new street manholes.

4. The 25-cycle switching facilities and the station electrical control room, located in a four-story gallery in the engine room and running the entire length of the 400-ft building adjacent to the boiler-room division wall. These must remain until complete cut-over to new 25-cycle switchgear and completion of the new station electrical control room in the Transformer and Switch House, at which time they will be demolished and removed.

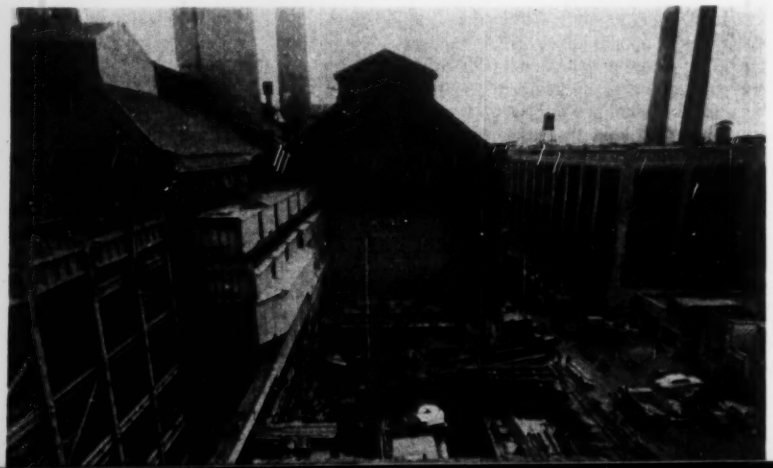
5. All electrical cable and control wiring and piping traversing areas of the engine room to be demolished. These were relocated with new material in areas not affected.

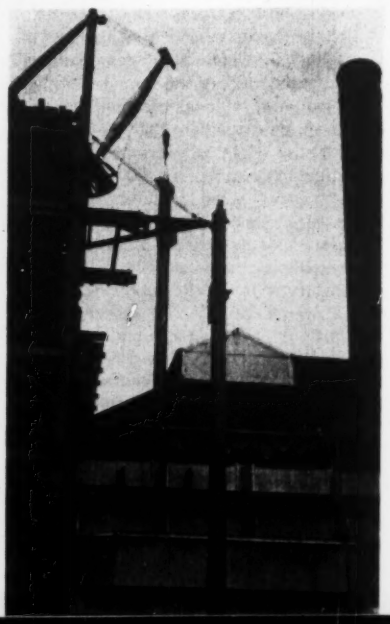
The layout of the plant, and more particularly the structural design, were carried out with due attention to the obstacles listed above. In numerous instances, such obstacles had a determining influence on the locations of steel columns, size and design of concrete foundations, and spacing of building bays.

The two new boilers were located in the cleared area west of the old boiler house. The future third boiler then can be constructed in the second phase, east of the first two, in the old boiler-room area without interfering with the two old brick stacks that are used by the low-pressure boilers.

The basement floor was maintained at the same elevation as that of the old boiler and engine rooms, approximately 15 ft below the sidewalk elevation. The boiler operating floor was placed 35 ft above the basement floor and at the same level as the new turbine-room operating floor. Because of

Excavation of discharge channel is in progress on site of demolished portion of old engine room. Bulkhead protects operating end of engine room in background. Just this side of bulkhead, 60-ton crane is in "moth balls." To left, note precarious position of 25-cycle switch gallery and control room, protected by corrugated asbestos siding. Temporary timber roof in foreground protects transformer house, which also has to be kept in operation pending completion of new facilities.





limited area around the boilers, the induced- and forced-draft fans, together with the air heaters, were placed on a fan floor above the boilers located 110 ft above the basement floor. The flat roof 25 ft above the fan floor supports the two (outdoor) electrostatic precipitators, their substation, a domestic water-supply tank, and a cooling-water expansion tank (both on steel towers), two stacks of 14-ft inside diameter, and all breeching ducts between fans, precipitators and stacks.

Five operating platforms are spaced vertically between the operationg floor and the fan floor for access to the boilers. Floors supporting equipment are concrete slabs on steel framing. All other floor areas have grating of rectangular pattern for maximum ventilation.

Three pulverizers for each boiler are located on the basement floor at the front or turbine-room side of the boilers. The boiler control room is on the operating floor, overlooking both boiler and turbine rooms, and opposite the middle of the final three-boiler arrangement.

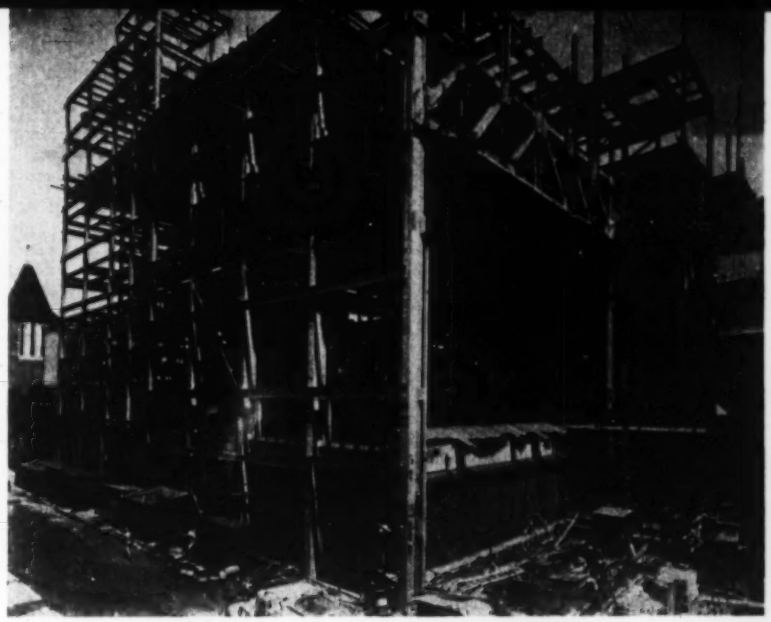
The new coal bunker is totally enclosed to restrict the dust nuisance. This permits the new boiler room to be open to the turbine room. The new boiler room will remain separated from the old boiler room by the west wall of the old boiler house. A section taken across the Boiler House and Turbine House, looking east toward the old plant, is shown in Fig. 2.

The new turbine generator was located opposite what will be the third boiler in the future three-boiler arrangement, a location determined by the old transformer house, which must temporarily remain in operation. This arrangement of turbine to boilers has required a difficult piping layout, especially since all connecting piping must traverse the old 25-cycle switch gallery area, not yet demolished. The present transformer house will be the location of the second turbine generator.

The two frequency converters are located at mezzanine level below the turbine floor, with their axis across the turbine room, between the new turbine generator and the westerly low-pressure unit in the old plant. The crane runway in the old structure has been extended the full length of the new turbine room. This extension, however, was designed to carry a future 140-ton crane instead of the two present cranes of 60- and 80-ton capacity.

Lack of a more economic location for the new 60-cycle switching facilities made it necessary to place them over the new turbine room. The roof over this room serves as an auxiliary switchgear gallery and cable area, in addition to having fan rooms for ventilation and several light repair shops. The two floors above house 60-cycle switchgear, reactors and associated equipment, and the top floor serves as office area for the Power Department and Generation Division of the New York City Transit Authority. From basement to roof, the Turbine House measures 152 ft.

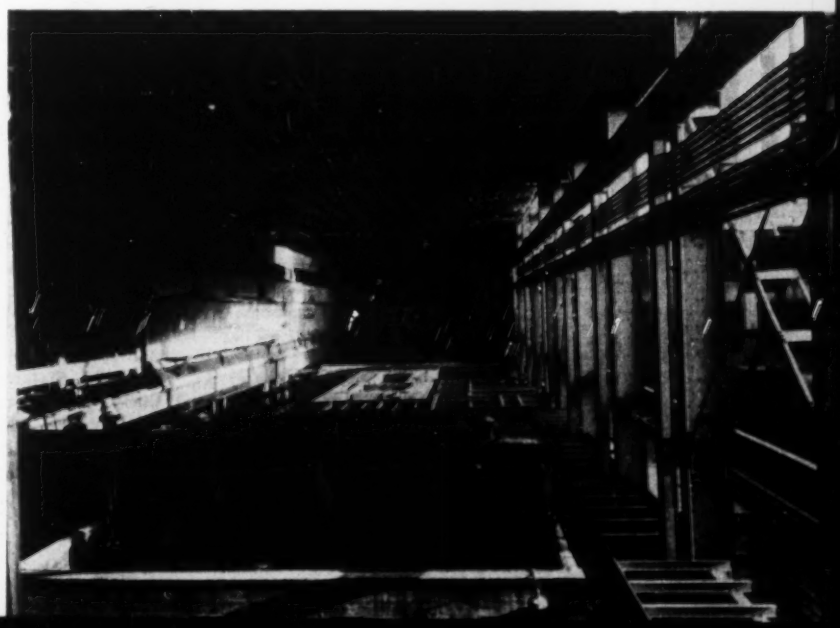
The new Turbine House has been extended into the old engine room to a point between the new turbine generator and the converters. Thus the new turbine generator is within the new structure, and the two converters are in the old engine-room structure. The space above the new turbine room provided for 60-cycle switching facilities is sufficient to take care of such equipment for two future turbine generators.



Unusually heavy structural frame is typical of those which span turbine room to support three heavily loaded equipment floors, one office floor, and roof. At left is 74th Street.

←

To place bents for new structure, "chimneys" had to be cut through 25-cycle switch gallery and electrical control room. Here derrick lowers section of column while workmen stand ready to guide it through a "chimney" with inches to spare. Later it will be connected to free-standing column at right, held in place temporarily by outrigger.



→

Later view taken in same direction as that at far left shows steel structure completed with formwork for floor in place above. Timber protection shown in other photo has been removed from old transformer house in foreground, which must temporarily remain in service.

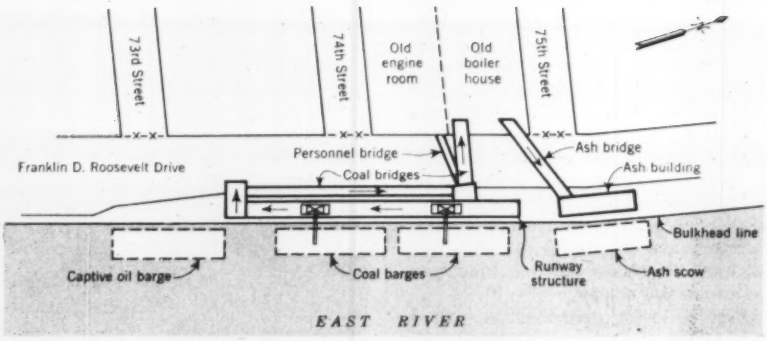


FIG. 3. New coal and ash handling facilities being built along East River are shown in plan. Coal bridge across Franklin D. Roosevelt Drive carries two belt conveyors and ash bridge carries vacuum ash system and bucket system serving old boilers.

The Transformer and Switch House (Fig. 2) serves the multiple function of transformer house and 25-cycle switch house on the 74th Street side, and plant personnel and service on the 75th Street side. All 25- and 60-cycle power transformers are located on the ground floor and are arranged from the 74th Street side in cells on each side of a pit with track and transfer truck. The detanking area is at the 74th Street end.

At the transformer or ground level, two cable vaults, one on each side of the Transformer and Switch House, run from 74th to 75th Street. The west vault extends to the under side of the next floor; the east vault extends up and into the vault floor below the control rooms. Outgoing feeder cables racked in these vaults drop into manholes located at each end of each vault, and continue on out to street manholes and the transmission system.

The 74th Street Plant has many layout features and special facilities that are of more than general interest to the civil engineer. Among these are the special precautions that were taken to protect, from damage or shutdown, the many vital facilities of the operating plant located in or adjacent to the demolition and construction areas. Before demolition of the old engine room began, that part of the engine room to remain in operation was completely sealed off from the construction area by a steel framed corrugated asbestos bulkhead. The 80-ton crane was placed in the operating part of the plant, while the 60-ton crane was left on the outside and completely "moth-balled" for protection against weather. The bulkhead was so designed that its top could be quickly demolished in emergency to allow the 60-ton crane to return to service in the old plant.

Approximately half of the 25-cycle switch galleries, including the station electric control room, also were in the demolition area and were similarly protected by a steel-framed corrugated asbestos wall and concrete plank with ply roofing. Provisions were made for ventilating and heating the galleries.

Foundations for the new power plant presented few problems. The underlying bedrock is typical Manhattan schist of generally sound character, which lies close to the surface. Spread footings for building columns were designed for a presumptive rock bearing capacity of 30 kips per sq ft.

Blasting was allowed for rock excavation in all areas, but was closely controlled in the engine room and other areas adjacent to operating equipment. In the engine room area, the maximum charge used for one shot was a total of $1^1/_2$ lb of 40-percent dynamite distributed in three holes. Blasting was also employed in the removal of the mass concrete foundations for the old reciprocating engines.

The condenser water intake and discharge channels for the new turbine were designed as extensions of the existing channels. A photograph shows excavation of the discharge channel in progress.

Unusually heavy steel frames

The structural steel frames across the turbine room that support three heavily loaded equipment floors, one office floor, and the roof above, are probably unusual in turbine-house design. A typical frame, with upper floors not yet erected, is shown in a photograph. The columns are 84 ft 0 in. on centers, as established by crane runway clearances and the size of the columns. The truss over the turbine room is 15 ft 0 in. deep between centers of chords, and the bottom chord is 86 ft 0 in. above the column base-plates. The two lower floors above the turbine room are framed into the panel points at the top and bottom chords. A separate stub column, tied back to the frame column, supports crane girder loads. The columns supporting the upper floors were designed for pin connections into the top chord of the truss. The main frame was designed as pinned at the column bases.

The columns of the frame consist of a 33 WF 240 with two 20 × 2 flange plates and two 28 × $1^1/_2$ web plates. They were shipped with a moment splice 27 ft 6 in. above their base for field erection. Each chord of the top truss is a 14 WF 264 in one piece, with web horizontal, with two $11^1/_2$ × 1, $1^1/_4$ or $1^1/_2$ web plates added in center bays as required. Web members are wide-flange sections of approximately 16-in. depth.

Location of the bents along the length of the turbine room presented a difficult problem inasmuch as the center line of the inside column leg plowed through all control-room panel boards and through four floors of 25-cycle switching equipment. Specific sections of panel boards and units of switchgear were removed and relocated, floor framing altered, and floors removed to make "chimneys" through the control room and all floors of the galleries to permit erection of the columns. The asbestos wall added to protect the galleries was framed around each "chimney." When the turbine-house frames were erected, the longer column pieces, each weighing 30 tons and 75 ft 3 in. long, were slipped into the "chimneys" from the top with inches to spare, and without incident.

The coal bunker is a rectangular shaped box 32 ft wide, 90 ft long, and 33 ft 4 in. deep, with twelve hoppers arranged in pairs and forming the bunker bottom. The hoppers measure 22 ft 8 in. down to the bottom outlet. Side plates are $^3/_8$ in. and hopper plates are $^1/_2$ in. The interior of the bunker is entirely lined with a calcium-aluminate cement mortar $2^1/_2$ in. thick, reinforced with 2 × 2, No. 12 gage, mesh fabric attached to the bunker plate with pin bars and welded studs. The lining is to protect the bunker plate against corrosion.

The bunker has a capacity of approximately 3,000 tons of coal, considered to be a 5- to 6-day supply at the plant's normal load factor. Each pair of bunker hoppers feeds one pulverizer through scales.

Several interesting features have been designed into the bunker for the purpose of preventing, minimizing, and combating bunker fires:

1. Each bunker hopper has two adjacent faces vertical and the other two sloping at 60 deg to the horizontal

to keep the coal from arching over and creating "dead coal" that starts hot spots.

2. Three poke holes are provided in the bottom section of each hopper, with poke rods permanently in place that can be worked conveniently from access platforms nearby.

3. Each hopper has an access ladder extending downward from the top of the bunker. Portable ladder sections 12 ft long make it possible to extend any ladder down to the bunker outlet.

4. Six 2-ft × 2-ft access doors are provided in the vertical face of the bunker proper at each of two levels on the boiler side.

5. A complete temperature monitoring system has been provided that continuously registers the temperature of the coal at 16 points in the bunker. By this system plant operators are forewarned of hot spots and can take the necessary steps to prevent fire.

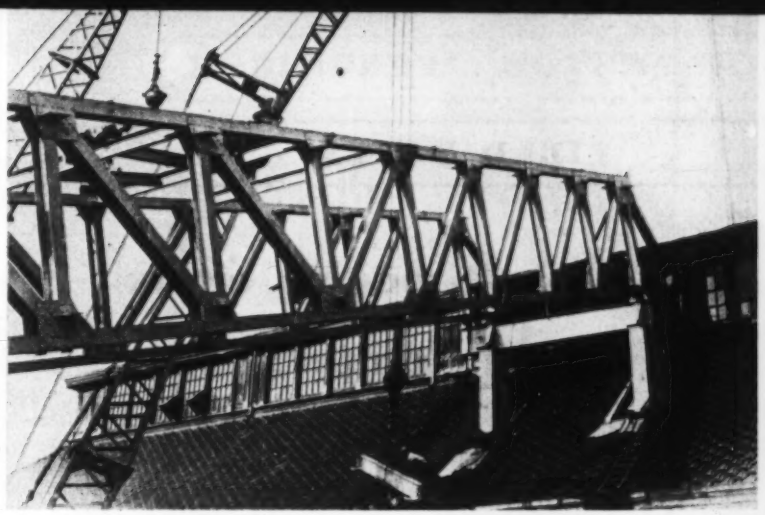
6. A coal-bunker unloading conveyor has been provided at the scale floor beneath the bunker to permit taking coal from any bunker hopper and feeding it to any pulverizer feeder. The operator-controlled conveyor is suitable for continuous operation and capable of intermittent start-stop and reversible operation when fully loaded.

Inasmuch as the 74th Street Plant is a structure developed in the vertical, due attention has been paid to vertical transportation. There are five elevators, all primarily for personnel but capable of being used for light freight. Enclosed stairwells are provided in the corners of all three buildings. Numerous open stairs are located in the boiler room and turbine room as required for plant operation.

The new structures are enclosed by masonry walls 12 in. thick. Glass has been used very sparingly and only for treatment at and over entrance doors, as an enclosure for the outside stairwell, and for light in office areas. Glass block is used in the exterior walls at locker-room floors in the service building.

The present system of coal and ash handling is old and unreliable and has long been the weakest link in the operation of the plant and a maintenance headache. The new system now under construction will have two movable coal unloading towers (Fig. 3) of modern design and two 36-in. belts for conveying the coal to both the old and the new bunker. Each unloading tower is rated at 2,000 long tons of slack coal per 8-hour day, and each belt is rated at 300 long tons of slack coal per hour.

The runway paralleling the East River, running north-south, will permit a 300-ft travel of the unloading towers, which is sufficient to unload two 2,000-ton barges simultaneously.



Completely new waterfront facilities are being built (see Fig. 3). Here Bethlehem Steel places girders for coal bridge across Franklin D. Roosevelt Drive. Bridge is supported at right on its own steel tower, which extends down through old building, later to be removed.

Existing narrow-gage cars will continue to handle ashes from old boilers in the new ash system. However they will be unloading into a new pivoted bucket conveyor that will bring the ashes up, across the Drive, and into bunkers in the new Ash Building. Fly ash from the new boilers and precipitators will be conveyed to the new Ash Building by a pneumatic system. A general plan of the new coal and ash handling structures and waterfront docking facilities is given in Fig. 3.

The present coal and ash system physically interferes with the completion of the entire new coal handling system. Consequently, an initial stage of construction must be restricted to completing that portion of the coal tower runway south of the present facilities, the new ash system, and one new coal belt over the old bunkers. As soon as this construction work is completed and one new coal belt is operating throughout the plant, the entire existing coal and ash systems will be demolished and the new ones completed.

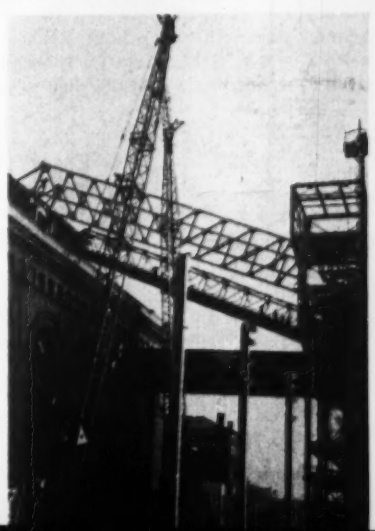
The first stage of modernization of the East 74th Street Power Plant is a definite step forward in replacing inefficient and obsolete facilities in the interest of economy and reliability. The improvements in this plant during the first twenty years of its existence made power-generation history, but this progressive maintenance unfortunately did not continue during the next thirty years. Consequently the first step of the present modernization becomes a giant step.

Engineering, design, and supervision of construction for this first stage of modernization are being done by The J. G. White Engineering Corporation for the New York City Transit Authority.

For The J. G. White Engineering Corporation, the following engineers played important roles: R. H. Barclay, Vice President in Charge of Engineering; M. P. Aillery, M.ASCE, Chief Structural Engineer; D. F. Phelps, Chief Mechanical Engineer; G. H. O'Sullivan, Chief Electrical Engineer; C. H. Wheeler, Jr., Architect; and E. L. Malone and S. C. Willis, M.ASCE, Resident Managers. The technical supervision for the Transit Authority was carried out under the direction of G. J. Tzougros, Assistant General Superintendent (Power); L. C. Benos, Superintendent (Power); and O. F. Peters and A. C. DeBear (Senior Electrical Engineers).

(This article has been prepared from the paper presented by Mr. Aillery at the ASCE Annual Convention in New York, before a Power Division session presided over by R. A. Sutherland, a member of the Division's Executive Committee.)

Another view shows coal-bridge framework just after it was raised into place. This bridge will carry two 36-in. belts delivering coal to bunkers, each belt rated at 300 long tons of slack coal per hour.



FIELD HINTS

Finding angle-reading errors in long traverses

DANA E. LOW

Member, Dartmouth College ASCE Student Chapter, Class of '55

The first thing a surveyor does after closing a traverse is to add up the interior angles and check to see if their sum is the proper multiple of 180 deg. All too often the result is disappointing, and it becomes obvious that an error has been made in reading one of the angles. Finding the station at which the error was made can be a difficult task under many conditions—if there are many or long legs in the traverse, if the traverse lines have become overgrown since the first readings were taken, or if time is of the essence.

Recently I was engaged in running a 45-leg traverse, through a heavily wooded area, which covered a total length of about 20,000 ft. We closed out with an error of 10 deg plus the expected small error of closure. Obviously a reading error had been made, but where? Within a very short time I predicted the origin of the 10-deg error and we were able to go to that station and reread the angle, thus saving ourselves the time and trouble of setting up and rereading the angles at every point.

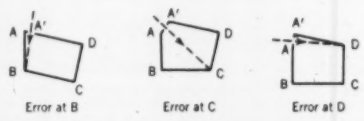
Here is how I solved the problem. Consider a simple traverse, ABCD:

First plot the traverse to scale. In the plotting no very great accuracy is required if the angle error is large. With a 10-deg error at B, C, or D, respectively, the plot would appear as follows:

Obviously any number of legs can be substituted for any one of the lines above, and as long as the end points are the same, the resulting relationship between A and A′ will not change.

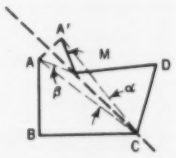
Since the error is concentrated at one point, it is only necessary to swing the traverse the required number of degrees about that station. This is fairly obvious since each leg has been correctly drawn with respect to the preceding one.

To find the station of error, erect a perpendicular bisector to the line joining the starting and closing points of the plot. This bisector will point right to the place where the bad reading was made, as shown below:



If there is a substantial accumulation of small errors as well as a large reading error, this method can only be expected to indicate the vicinity in which the large reading error was made. However, two or three transit setups will probably suffice to find it.

If more than one point lies near the line described, the right one is that which subtends the angle of error at line AA′. Below is shown traverse ABCD with side DA altered to put point M in the position indicated:



If the suspected reading error is α, the point at which this error was made is C. Likewise β points to M as a likely point for the bad reading.

There is nothing complex about this method. It is simply a realization and application of the geometric properties of a traverse. The fact that it does not appear in several outstanding texts on surveying indicates that often such time-saving devices are overlooked.

Resistance to

RALPH W. POWELL, M. ASCE

Most of the experts in pipe friction in recent years have recommended the use of the Stanton diagram (less correctly called by some the Moody diagram), which is a logarithmic plotting of f and $\mathbf{R}$, that is, of $\frac{2\,gh_f D}{LV^2}$ against $\frac{VD}{\nu}$. The formula generally used for the construction of such a diagram is that proposed in 1939 by C. F. Colebrook of England. It is

$$\frac{1}{\sqrt{f}} = 1.74 - 2\log\left(\frac{\epsilon}{r_0} + \frac{18.7}{\mathbf{R}\sqrt{f}}\right)$$

where r_0 is the radius of the pipe and ϵ is the "equivalent roughness" of the pipe, that is, the size of sand grain, as used by Nikuradse, which would give the same f at high Reynolds numbers. For smooth pipes, $\epsilon = 0$.

The Stanton diagram is very useful where the size of pipe and quantity of flow are given and the loss of head is to be found. On the other hand, where the size of pipe and loss of head are given and the quantity of flow is unknown, this diagram requires a cut-and-try solution. But the problem can be solved directly by a modified diagram obtained by plotting f against

$$\mathbf{J} = \mathbf{R}\sqrt{f} = \frac{D^{3/2}\sqrt{2gS}}{\nu}$$

This seems to have been first pointed out by S. P. Johnson in 1934.

The third problem, that of selecting the proper size of pipe to carry a given flow with a given loss of head, can still be solved only by cut and try even if both of these diagrams are available. In 1948, A. E. Bretting of Copenhagen, Denmark, published a diagram for solving this third problem directly. The writer published a modification of it in the September 1950 issue of CIVIL ENGINEERING (pp. 45–46). The diagrams are a plotting of three dimensionless numbers:

$$X = \frac{S\epsilon^3 g}{\nu^2},\quad Y = \frac{Q}{\epsilon\nu},\text{ and } Z = \frac{D}{\epsilon}$$

These diagrams are quite satisfactory for rough pipes, but they do not cover the case of smooth pipes because, when $\epsilon = 0$, X is zero, and Y and Z become infinite.

flow in smooth pipes found directly

Professor of Engineering Mechanics
Ohio State University, Columbus, Ohio

To find the size of a smooth pipe to carry a given flow with a given loss of head, S. P. Johnston suggested another dimensionless number,

$$\mathbf{T} = \frac{(Q^3\,Sg)^{0.2}}{\nu}$$

If in this we substitute

$$Q = \frac{\pi D^2 V}{4} \text{ and } S = \frac{fV^2}{2gD},$$

$$\text{we get } \mathbf{T} = \frac{\pi^{0.6}}{2^{1.4}} \cdot \frac{DV}{\nu} \cdot f^{0.2}$$

or $\log \mathbf{T} = \log \mathbf{R} + 0.2 \log f - 0.12315$.

Using Prandtl's formula for smooth-pipe resistance, $\frac{1}{\sqrt{f}} = 2.00 \log (\mathbf{R}\sqrt{f}) - 0.80 = 2 \log \mathbf{J} - 0.80$, values of **J**, **R**, and **T** were computed for f = 0.008, 0.010, 0.012, 0.014, 0.016, 0.018, 0.020, 0.024, 0.028, 0.032, 0.036, and 0.040. When **J** was plotted against **T** on log-log paper, it was found to give practically a straight line. Fitting a straight line to these points by least squares gave

$$\mathbf{T} = 1.286\mathbf{J}^{1.0682}$$

which reduces to

$$D = 0.329 Q^{0.374} \nu^{0.0428} \left(\frac{1}{S}\right)^{0.208} \quad (1)$$

Figure 1 is an alignment chart for solving this equation. To use it, lay a straightedge from the value of Q to the value of the kinematic viscosity. Join the point where this crosses the pivot line with the value of the loss of head per 1,000 ft, and this line extended to the left gives the required size of pipe.

Solving the above formula for V gives

$$V = \frac{24.80 D^{0.672} S^{0.557}}{\nu^{0.1143}} \quad (2)$$

For water at 58.1 deg F, ν = 0.0000125 and

$$V = 90.13 D^{0.672} S^{0.557} \quad (3)$$

This is reminiscent of Hazen and William's formula, but the difference is appreciable. For a diameter of one foot it gives about 17 percent more than the formula of E. A. Moritz for wood-stave pipe published in 1910, and nearly 20 percent more than that proposed by Fred C. Scobey in 1916 for the same kind of pipe. Since these formulas were for actual pipe as laid, and the above formula is for ideally smooth, uniform straight pipe, the difference is perhaps not surprising. The exponent of S in these two formulas was 0.555, and the exponents of D were 0.70 and 0.65 respectively, which is in fair agreement with the new formula.

Figure 2 is a plotting of Eq. 3 and is convenient for finding the required size of smooth pipe to carry water at ordinary temperatures. The lines are stopped at **R** = 2000, and dashed from **R** = 4000. For commercial pipe, the value of the head loss should be decreased, say, 10 percent before entering the graph, but this will have little effect on the size.

As an example of the use of the graphs, find the required size of smooth pipe to carry 10 cfs of water at 58.1 deg F, with a head loss of 100 ft per 1,000 ft. In Fig. 1 connect the point representing a viscosity of 0.0000125 sq ft per sec, with the point representing a discharge of 10 cfs. Mark the point where this straight line crosses the pivot line. A straight line through this point and the point representing 100-ft loss of head per 1,000 ft crosses the diameter line at 9.3 in., which is the required diameter. Figure 2 checks this result within about 1 percent.

For a pipe of given roughness, the graph in the September 1950 CIVIL ENGINEERING referred to above may be used, or the size of smooth pipe may be found by Figs. 1 or 2, and a size slightly larger than that indicated can be used as a first trial for a cut-and-try solution with a Stanton diagram.

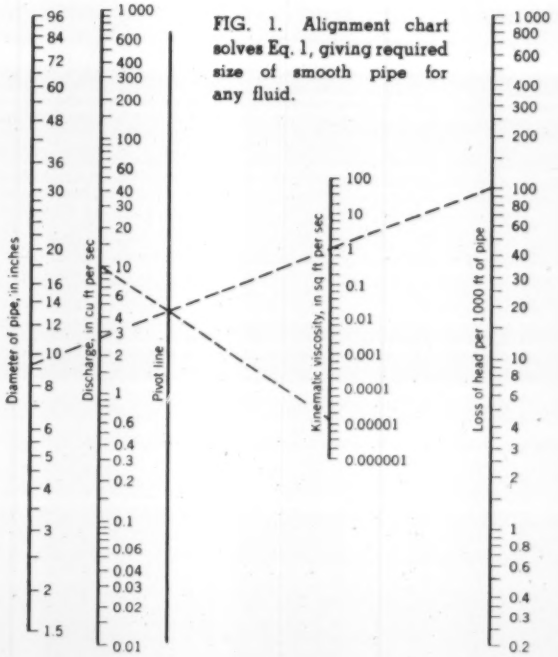

Diameter of pipe, in inches
Discharge, in cu ft per sec
Pivot line
Kinematic viscosity, in sq ft per sec
Loss of head per 1 000 ft of pipe

FIG. 1. Alignment chart solves Eq. 1, giving required size of smooth pipe for any fluid.

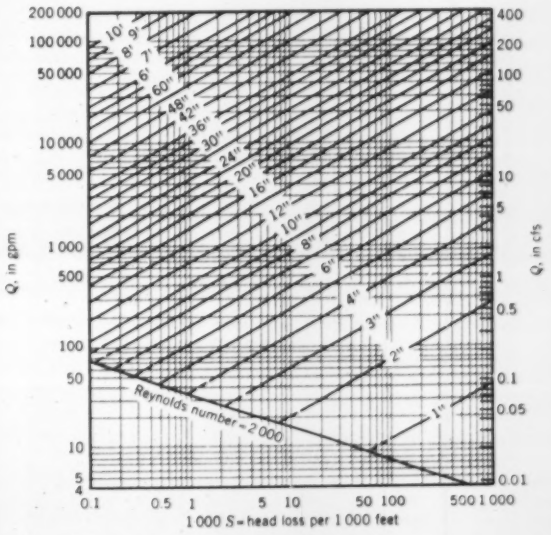


FIG. 2. Plotting of Eq. 3 makes convenient nomogram for finding required size of smooth pipe to carry water at ordinary temperatures, specifically at 58.1 deg F.

In view of test under way in Garfield Thomas Water Tunnel, operating console is in foreground and water tunnel in background, with object under test visible through working-section windows. Theodolite (not shown) is mounted on top of console.

Theodolite found useful in hydraulic testing

A. F. LEHMAN, Research Associate

J. M. ROBERTSON, M. ASCE, Professor of Engineering Research

Ordnance Research Laboratory, The Pennsylvania State University

State College, Pa.

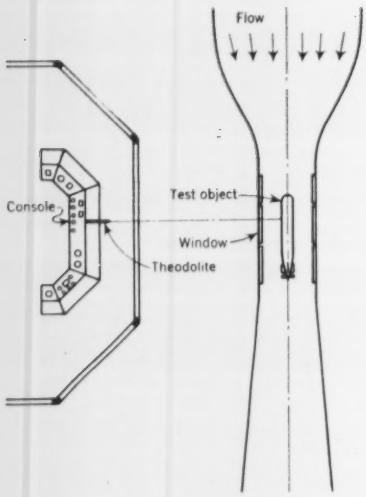


FIG. 1. Theodolite is mounted rigidly to sight on target pointed on side of test body in water tunnel, in tests requiring measurement of drag force on a body.

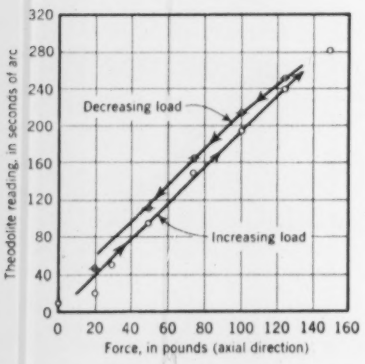


FIG. 2. In a typical calibration, measured displacements of vehicle in tunnel, without water, were plotted against the known forces applied.

In a recent series of tests at the Garfield Thomas Water Tunnel (operated under contract with the Navy Bureau of Ordnance) at the Pennsylvania State University, it was necessary to determine the force on a body by measuring its displacement when a load was applied. Since the body was to be mounted in a moving stream of water, the usual methods of measuring such deflections could not be used without disturbing the flow pattern about the object. Because such disturbance in the flow pattern would invalidate the test results, a method of measuring deflections through the use of a precision surveying instrument was devised that does not disturb the flow pattern. This method can be applied to the solution of a wide variety of deflection problems where the testing medium must not be disturbed or where it is difficult to gain access to the object under test.

At the Garfield Thomas Water Tunnel, bodies of 2 to 12 in. in diameter and of lengths up to 8 ft are tested in a water jet, 48 in. in diameter, at speeds up to 70 ft per sec. To determine the force on the test bodies caused by the flow of water past them, a six-component balance was designed and constructed employing strain-gaged beams to weigh the forces. This design follows in principle the normal procedure used to obtain forces in a wind or air tunnel, in which a balance is integrated in some manner with the strut that supports the body in the flow. In adapting this principle for use in a water tunnel, however, problems caused by difficulties in sealing the water and maintaining a dynamically stable system arose that have not yet been completely solved.

Consequently, to conduct a recent series of tests in which it was necessary to measure the drag force on a body, a new deflection-measuring system was devised. In this system, the test object was mounted on a yoke supported by leaf springs. The yoke, in turn, was fastened to the support strut. In this arrangement, the deflection of the body was proportional to the force, and a calibration of the springs would permit measured deflections to be converted into force measurements.

The most difficult problem in this system was that of measuring the deflections without disturbing the flow in the 2 ft of water between the test object and the wall of the tunnel. After an optical system (employing a light beam shining on a mirror inserted in the surface of the test body) proved unsatisfactory, it was decided to use a precision surveying instrument to read deflection of the body as an angle.

A theodolite was mounted rigidly to sight on a target painted on the side of the test body, as shown in Fig. 1. The unit was calibrated in the tunnel, but before it was filled with water, with a test rig that allowed axial forces to be applied to the body. In this calibration, measured displacements of the vehicle were recorded for the application of known forces. A typical calibration is shown in Fig. 2. After the calibration was completed, deflections measured as angles during the test were easily converted into force indications.

Although the theodolite could be read to the nearest $^1/_{10}$ sec of arc, repeatability in sighting the cross hair on the target was limited to within 2 sec of arc. The inability to secure exact repeatability was caused by difficulty in obtaining a sharp target while sighting through a sandwich-type window and 2 ft of water. This window is composed of a 2-in. layer of water trapped between a flat surface of plate glass on the outside and a curved 4-in.-thick plexiglas pressure window on the inside. However, for the spring used, a 1-lb force

caused a deflection of 1.94 sec of arc; consequently, the force measurements were accurate to within 1 lb. As the majority of forces being measured were between 50 and 150 lb, the error resulting from difficulties in reading the deflection angle was never greater than 2 percent.

The use and operation of the theodolite was entirely satisfactory throughout the test program, and the application of this method to similar problems is limited primarily by the hysteresis in the spring and mounting system rather than by limitations of the instrument. The effects of hysteresis, as seen in Fig. 2, may be largely avoided if attention is paid to the sense of the force loading.

An overall view of the operating console during testing operations is given in the accompanying photograph. The object undergoing test is visible through the working-section windows in the right background. While the theodolite is not shown in this photo, it was mounted on top of the console near the center.

(On October 15, 1954, Professor Robertson joined the staff of the University of Illinois as Professor of Theoretical and Applied Mechanics.)

THE READERS WRITE

American engineers can learn much from the French

TO THE EDITOR: The opportunity to study the French way of life came to me in the form of a year's scholarship from the French Government under the auspices of the Institute of International Education in New York, for the study of hydraulics and fluid mechanics at the University of Toulouse.

Probably the most striking difference I first noticed in Southern France was the slower tempo of living. This seemed to bring with it warmer and more expressive human relations in everyday affairs. Instead of wanting to "keep up with the Jones's," most Frenchmen seem to want to be just a little different from their fellows.

From the first day of my studies in fluid mechanics I became immersed in the abstract world of mathematics, with emphasis on general principles. In the United States we work instead rather in the opposite direction, with liberal use of graphs, curves and descriptive matter. In my effort to adapt myself to this new approach, I became aware of my own shortcomings and of some of the weaknesses of our educational system. At least a part of the blame for our failures both individually and collectively can be laid at the door of a school system which seeks to make everything as easy as possible. With the French type of discipline, the student is better equipped mentally to solve unusual problems because of his solid mathematical background. The methods popular in this country, while certainly tending to develop a practical engineer, often leave him hidebound by convention and lacking in imagination to see unusual solutions and different ways of doing a job.

After graduation from the Lycée, or high school, the French engineering student must spend two years on a broad curriculum. In addition to mathematics, physics, chemistry and the natural sciences, he studies geography, history, literature, music, the arts, political science, languages, and philosophy, and must pass a stiff examination in these subjects before being admitted to the preparatory year of engineering studies. The effect of this emphasis on a broad and general education is evident in the temperament of the French engineering student and in his effort to be an interesting person. I was surprised to find engineering students discussing literature, the arts, sociology and even the geography of America.

During my last month in France I visited hydraulic laboratories, hydroelectric installations, and hydraulic machinery manufacturing plants. One does not find French projects which are not well planned and meticulously designed. Since the Frenchman is inclined to be frugal, he generally does not overdesign. The rule seems to be to design to closer tolerances, with more closely controlled material standards, along with more theoretically precise engineering practices.

In the factory, I was struck by the emphasis on artisan-worker technique. In spite of a lower standard of living, the French worker seems to have more of a sense of responsibility for his work, believing that doing a good job, and creating something a bit uniquely his own, are important values in themselves.

The following summary suggests some of the gains that I believe could be achieved by applying some of the ideas of the French. In the first place, students of all ages could be given an increased sense of individual responsibility in their work, coupled with more of a feeling of intellectual freedom. Education in our country has been so watered down in an attempt to "make it easier" for the student that he becomes spoon fed and stilted in his intellectual growth. The sooner the child learns that there is no "easy" way to learning, the sooner he will realize that there is no "easy" way of living. Being able to take the knocks is better both for him and for the rest of us. If the student cannot measure up to higher standards, let both him and his parents accept his limitations and look towards fields not requiring such rigorous training.

Two-year pre-engineering courses, with entrance to the engineering school by competitive examination, might be a step in the right direction. These two additional years of classical and general studies should turn out a less lop-sided engineer. The present system of sprinkling the engineering curriculum with courses in the humanities gives no sense of integration. It is rather like dumping salt and pepper on a tough steak to make it more palatable.

Why not, instead of increasing the number of half-educated engineers, increase the number of good technicians educated in less rigorous schools? In time we would emerge with a profession not only able to solve tough engineering problems, but also capable of understanding the effects of new technologies on people and societies. We would have a group of real leaders.

We as engineers must learn, by a reassessment of our sense of values, to develop a more relaxed attitude toward material progress. While material goods certainly are assets to enjoyable living, they must not be looked upon as ends in themselves, but rather as a means to warmer human relationships. Increased creative effort on the part of all of us would help to offset the materialistic slant that besets many of us.

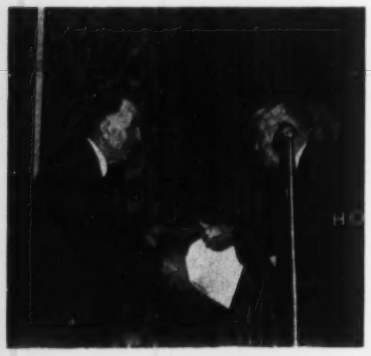
If only we can temper our genius for productivity with a little of the wisdom of restraint, patience, more careful planning, and greater precision, our technology will be a better one. If we are able to temper our technology with a little broader view of life, a little more beauty, ours will be, in addition to the rich nation it is today, a little happier and a little wiser as well.

LOUIS AELRED VOLSE, A.M. ASCE
Los Angeles, Calif.

SOCIETY NEWS

Memorable Program Marks Society's 1954 Annual Convention

An "unusually satisfactory meeting" and a "meeting with a good atmosphere" were phrases applied by more than one member to this year's Annual Convention, held at the Statler Hotel, in New York, October 18-22. Certain it is that the week-long program offered something for every taste and interest represented in the registration of over 1,800. In addition to the usual Annual Convention features, including induction of officers and presentation of honors and awards, there was a technical program second only in size and scope to that arranged for the Centennial celebration two years ago.



Conditions of Practice Session

A wish for more Junior Member programs must have been aroused in all attending the Monday afternoon Conditions of Practice program, easily the most exciting of the thirty-two technical sessions. Enthusiastic young engineers by the hundred crowded the Statler's Georgian Room for the all-afternoon meeting, an offshoot of the work of the Society's recently formed Committee on Conditions of Practice. At the Employers-Employees Luncheon preceding the program, the featured talk, by Carl B. Jansen, M. ASCE, president of the Dravo Corp., set the stage for the afternoon discussion of the basic relationship between employers and their young engineer employees.

Mr. Jansen's paper, entitled "Construction—an Engineer's Challenge," ably summarized the multitudinous factors involved in bidding and undertaking a job and in selecting adequate personnel for it. It also emphasized the tremendous satisfactions inherent in construction. "If you enjoy seeing your work grow beneath your hand, construction will give you a lift," Mr. Jansen said. His paper will be published in an early issue.

In organizing the Committee on Conditions of Practice, ASCE took one of the most significant steps in its history, Mason Lockwood, Vice-President of the Society and incoming chairman of the Committee on Conditions of Practice, told the young engineers attending the Conditions of Practice Session. "No longer can the younger members say they are a neglected group," said Mr. Lockwood, pointing out that the new ASCE committee "provides the mechanism for a very wide range of activities and interests." In a talk on "The Young Engineer in Construction" that led off the program Dwight W. Winkelman, M. ASCE, past-president of the Associated General Contractors and president of D. W. Winkelman & Co.,

In Wednesday morning ceremonies James K. Finch (top photo), dean emeritus of engineering at Columbia University receives a special award of the Board of Direction for his paper on "One Hundred Years of Civil Engineering" in the Centennial volume of "Transactions." At the same session Executive Secretary William N. Carey (middle view) presents the Secretary's report. Photos at the bottom of the page, taken at the popular Conditions of Practice session, show (left-hand view) Dwight W. Winkleman, construction engineer of Syracuse, delivering his paper on "The Young Engineer in Construction," while Moderator Finley Laverty listens; Eugene D. Jones (middle photo), president of the Junior Forum of the Metropolitan Section; and William J. Carroll, Jr., of Pasadena, Calif., whose paper is printed in this issue.

The new President, William R. Glidden (right in the left-hand view) greets William H. Wisely, of Champaign, Ill., who will become Executive Secretary of the Society upon Mr. Carey's retirement next spring. In the group photo ASCE Past-Presidents breakfast with retiring President Terrell. Shown in usual order are Gail A. Hathaway, W. W. Horner, Ezra B. Whitman, Dean Terrell, Walter L. Huber, Carlton S. Proctor, Richard E. Dougherty, and John C. Stevens.

asserted that there are "greater opportunities for civil engineers in construction today than at any other time in history in building for the strength and defense of the country." With construction the No. 1 industry in the country and accounting for one out of every seven dollars of the gross national product, the opportunities for young engineers in the field are virtually unlimited he said. Mr. Winkelman's paper will also be published in an early issue.

The two papers by Junior Members—Robert M. Olson, of Houston, Tex., and William J. Carroll, Jr., of Pasadena, Calif.—revealed what the younger members are thinking about economics and other phases of professional recognition in two large areas of the country. Mr. Olson's paper, which is based on the results of a Texas Section survey of Junior Member opinion, will appear later. Mr. Carroll's paper, which presents observations and conclusions of the Salary Committee of the Los Angeles Section's Junior Forum, of which he is chairman, appears elsewhere in this issue.

In the final paper of the afternoon Elmer K. Timby, M. ASCE, partner in the New York and Kansas City firm of Howard, Needles, Tammen & Bergendoff, discussed "Civil Engineering—a Career." Mr. Timby, former chairman of the Society's Construction Division and chairman of ASCE's Research Committee, warned his hearers that "civil engineering is just plain hard work 95 percent of the time." As compensations, he stressed the breadth and maturity of the profession and its essential creativeness, in contrast to some of the other professions that "spend more time correcting than creating." In his opinion, "Unionism won't boost a man's status or upgrade his recognition. If he displays real ability, his services will be recognized."

A selected group of young engineers in the Metropolitan Section discussed the papers briefly and to the point. They were Louis J. Capozzoli, Jr., Joseph S. Ward, Milton Alpern, and Howard Grill. In a dramatic finale to the program, Assistant Secretary E. Lawrence Chandler noted that the profession probably has more recognition than it realizes. As a case in point, he mentioned that the New York Times, "which does not throw its words around," devoted its entire Topics of the Times for October 18 to the Society and its Convention and quoted the conclusion of the write-up: "Perhaps we should ponder again what John Bright said a long time ago: 'Who are the greatest men of the present age? Not your warriors, not your statesmen; they are your enginers.'" The Conditions of Practice Session was moderated by Finley Laverty, of the Committee on Junior Members, and Eugene D. Jones, president of the Junior Branch of the Metropolitan Section.

New Officers Inducted

During the Wednesday morning business session retiring President Daniel V. Terrell paid warm tribute to Executive Secretary William N. Carey, who is retiring in the spring after ten years in the post. In his response Secretary Carey introduced his successor, William H. Wisely, M. ASCE, of Champaign, Ill. The customary prizes for papers in TRANSACTIONS were then presented to thirteen engineers. James K. Finch, M. ASCE, dean emeritus of engineering at Columbia University, received a special award of the Board of Direction for his paper on "One Hundred Years of Civil Engineering" in the Centennial volume of TRANSACTIONS, which did not come within the scope of the regular ASCE prizes.

At the close of the meeting William R. Glidden, assistant chief engineer of the Virginia Department of Highways, took office as 86th president of the Society. Also installed were two Vice-Presidents—Frank L. Weaver, of Washington, D.C., for Zone II, and Louis R. Howson, of Chicago, for Zone III. The new Directors inducted are Jewell M. Garrelts, District 1; Frederick H. Paulson, District 2; George S. Richardson, District 6; Don M. Corbett, District 9; Graham P. Willoughby, District 10; and Lawrence A. Elsener, District 11. Some of the immediate issues facing the Society were discussed by Mr. Glidden in his thoughtful inaugural address published on page 40. These include the need for redistricting studies, the need for expanded Highway Division activity in conformity with the new importance of highways in the national scene, and the competitive bidding for engineering services situation.

Wednesday Membership Luncheon

An important feature of the annual membership luncheon, held Wednesday noon, was the presentation of certificates of honorary membership in the Society to three outstanding members—Robert J. Cummins, of Houston, Tex.; Shortridge Hardesty, of New York City; and Edward P. Lupfer, of Buffalo, N.Y. Retiring President Terrell made the awards and read the accompanying citations. Mr. Cummins was honored as "Eminent consultant, pioneer in the engineering development of the great port of Houston, and distinguished citizen of Texas"; Mr. Hardesty as "Distinguished consultant, internationally famed bridge engineer, particularly in the field of notable structures, and important contributor to column research"; and Mr. Lupfer "In recognition of a lifetime of brilliant engineering work in New York State, distinguished service to the Society, and important wartime aid to his country."

Dr. Grayson Kirk Speaks

The Wednesday luncheon was also distinguished by an unusual address, made by Dr. Grayson Kirk, president of Colum-

Dr. Grayson Kirk (lower left), president of Columbia University, addresses Wednesday Membership Luncheon on "The Modern Leonardo." The snapshots at the top of the page, also taken at the luncheon, show the Society's three new Honorary Members receiving their citations and awards from retiring President Terrell. They are (right in each of the three views) Robert J. Cummins, of Houston, Tex., Shortridge Hardesty, of New York City, and Edward P. Lupfer, of Buffalo, N. Y.

bia University, whose part in the program honored the university's bicentennial, which is being celebrated this year. Dr. Kirk, who is widely known as an author, teacher, and statesman, developed the theme, "The Modern Leonardo," in a talk emphasizing the need for resistance to today's "threat to intellectual freedom and menace to life such as has not existed since the Middle Ages."

Emphasizing the special appropriateness of the bicentennial theme of "Man's right to knowledge and the free use thereof," Dr. Kirk urged his hearers to take a decisive stand in "the great battle for the freedom of men's minds." Pointing to the threat to intellectual freedom represented by both the Iron Curtain and the extreme right, he said "We need more intelligence, more clear thinking than ever before if our society is to survive. We bear burdens not borne before . . . . We must be modern Leonardos to meet our manifold obligations effectively." As a practical means of proceeding, Dr Kirk suggested that we be more mature in assessing the capabilities and capacities of our country without being boastful and yet without giving way to despair.

Many Interesting Speakers

With the Convention roster of speakers sounding like "Who's Who in Engineering," it is impossible to mention all the notables on the program. Two talks attracting wide attention were Francis V. duPont's featured address at the Highway Planning Luncheon on Thursday, and the paper read by Maj. Gen. S. D. Sturgis, Jr., at one of the two sessions sponsored by the Construction Division's newly formed Committee on Pipelines. Mr. duPont, who is commissioner of the U.S. Bureau of Public Roads, commented on today's gargantuan highway problem, with particular reference to the President's proposed $50 billion road program. He said that President Eisenhower is the first President to suggest a specific road plan. In a paper entitled "The Pipeline Carries the Punch," General Sturgis spoke of the "almost epic significance" of pipelines to the military engineer. In any future war, he said, "out of the military pipelines will flow the petroleum products, which will determine the Armed Forces' ability to move and maneuver." General Sturgis also outlined improvements being made in the pipeline program, which will make the lines better able to handle the increasing demands placed upon them.

The Construction Division also sponsored an extensive informative session on construction equipment, with attention to choice, capacities, and economies by speakers representing four large manufacturers. The papers were so well received that hope was expressed they would form the nucleus of publications concerned with equipment operating data. A series of articles will begin in the December issue of CIVIL ENGINEERING.

Prestressed Concrete Studied

At a very well attended Structural Division session the present status of prestressing practices in highway bridges—the results of a recent survey—was reviewed. Discussion indicated the possibility of raising the working stresses in prestressing steel. Also of special interest was a Structural Division session devoted to discussing research conducted on both riveted and bolted connections, together with the present status of application.

St. Lawrence Seaway Luncheon

As was to be expected, there was a large turnout for the St. Lawrence Seaway Luncheon on Tuesday, which was sponsored jointly by the Waterways, Hydraulics, and Power Divisions. In the featured address, Brig. Gen. E. C. Itschner, Assistant Chief of Engineers for Civil Works, U.S. Army, revealed that work has started on both the seaway and power projects—a job that will ultimately cost in the neighborhood of $900,000,000. General Itschner's paper is published elsewhere in this issue.

Field Trips and Social Program

Contributing mightily to the success of the Convention were the varied and interesting social events and the numerous trips arranged for both the engineers and their ladies. The trips culminated in a joint boat tour of Manhattan and New York Harbor on Friday that gave the ladies an outing and the members a general view of the multitudinous waterfront projects currently under construction. New York's much-vaunted October weather was at its best for the occasion.

Convention Committees

Much credit for the smoothly run Convention goes to the numerous committees of Metropolitan Section members who have worked long and hard. The committees were headed by Jewell M. Garrelts as general chairman and John R. Zehner as vice-chairman.

President Glidden is shown with a group of engineering students (VMI cadets) from his home state of Virginia in the view at the left. The scene at the right is the President's reception line at the gala Wednesday evening dinner-dance.

Actions of ASCE Board of Direction Briefed

Principal actions of the ASCE Board of Direction, taken at its meetings during the Annual Convention in New York, October 18-22, are summarized here.

New Plan for Retirement System

On recommendation of a special task committee headed by Past-Director Francis S. Friel, the Board of Direction voted to enter into an agreement with the Connecticut General Life Insurance Company on a new plan for the retirement system for the salaried employees of the Society. The present retirement system was founded in 1940 on a self-insured basis—that is, the Society is virtually its own insurance company. In both the old and new plans, the employees contribute $4^1/_2$ percent of their salaries and the Society makes up the balance of the funds required to finance the system.

Local Section Allotment

The Board established a new formula for rebating part of member dues to Local Sections. The new formula provides for an annual allotment of $50 to each Local Section and authorized Branch or Subsection, plus $25 for each Student Chapter in each Local Section area, plus $2.00 for each dues-paying member of each Section, Subsection, or Branch.

Assignment of Members Residing Abroad

Preparation of a bylaw change was authorized to permit any member on temporary assignment outside the United States to retain his United States residential assignment at his option instead of being automatically assigned to District 1 of Zone I.

Plans for a "Research Digest"

The Committee on Research suggested that steps be taken toward establishing a "Research Digest" covering civil engineering subjects. The Board approved the idea in principle and directed the committee to explore the possibilities of financing such a program and to report back to the Board of Direction as soon as practicable.

Daniel Mead Prizes Awarded

Award of the Daniel Mead Prizes for papers on ethics to a Junior Member and a Student Chapter member was approved by the Board. The recipients are Alfred E. Waters, J. M. ASCE, structural engineer, Quinton Engineers, Ltd., Los Angeles, and William H. Blackmer, member of the University of California Student Chapter.

Report of Committee on Budget

The Board of Direction requested that the letter portion of the report of the Committee on the Budget be printed in CIVIL ENGINEERING (see page 70).

Brochure on Engineering Education

On recommendation of the Committee on Engineering Education, the Board of Direction approved the preparation of a short brochure on engineering education by the committee.

Advisory Committee on Highways

The Board of Direction empowered the President to appoint a special task committee, in conjunction with President Eisenhower's Advisory Committee on a National Highway Program, to study the proposed program and to recommend appropriate actions that might be taken on it by ASCE.

Advertising by Engineers

Relative to advertising by engineers, the Committee on Professional Practice divided such advertisers into two groups:

(*a*) Those offering professional engineering services only

(*b*) Those offering a combination of professional engineering services with management, contracting and building, financing, and personnel employment, and stated "ASCE cannot impose restrictions on its members in group (*b*) which offers services other than professional engineering. However, in advertisements of this character the offer of professional engineering services should not be commingled with the offer of those other services.

The committee made the following recommendations:

1. Advertisements which constitute an offer of professional engineering services should be limited to the simple professional card. Such professional cards should appear only in publications having a professional directory or section.

2. It is considered proper to furnish potential clients with a brochure including pictures and illustrations of important works, completed by the engineers in question, together with a factual statement concerning the accomplishments of the firm and its key personnel.

The Board of Direction approved these recommendations as representing the policy and attitude of the Society on the subject. It also instructed the Committee on Professional Practice to prepare a supplement to Manual No. 29, including "a section on advertising and a section on combined engineering and construction services versus separate engineering and construction . . . to inform engineers and clients alike of the possible effect on the client."

Incoming Board of Direction is photographed during one of its Annual Convention sessions. In front row (left to right) are William N. Carey, Executive Secretary; Frank L. Weaver, Vice-President, Zone II; Mason Lockwood, Vice-President, Zone IV; Daniel V. Terrell, Past-President; William R. Glidden, President; Walter L. Huber, Past-President; Enoch R. Needles, Vice-President, Zone I; Louis R. Howson, Vice-President, Zone III; and Charles E. Trout, Treasurer. Second row shows George S. Richardson, Director, District 6; Oliver W. Hartwell, Director, District 4; William S. LaLonde, Jr., Director, District 1; Samuel B. Morris, Director, District 11; Jewell M. Garrelts, Director, District 1; Lloyd D. Knapp, Director, District 7; and Frederick H. Paulson, Director, District 2. In the third row are Lawrence A. Elsener, Director, District 11; Carl G. Paulsen, Director, District 5; Glenn W. Holcomb, Director, District 12; Don M. Corbett, Director, District 9; Francis M. Dawson, Director, District 16; Graham P. Willoughby, Director, District 10; Raymond F. Dawson, Director, District 15; A. A. K. Booth, Director, District 3; and Thomas C. Shedd, Director, District 8.

ASCE Budget Committee Makes Recommendations

(These recommendations were adopted by the Board of Direction at its meeting during the Annual Convention.)

To the Board of Direction, ASCE:

Due to favorable result of the balloting on the amendment to the Constitution relative to an increase in dues, your Society is in a greatly strengthened financial condition. Instead of a restricted and technically deficit budget as for 1954, the prospective income for 1955 has allowed freedom of movement in practically every phase of Society endeavor and has made provision for increased and beneficial activity in many fields. This newly found freedom makes it possible to think rather broadly concerning Society affairs, to review again our channels of income and outgo and to weigh the relative import of each.

Prompted by President Terrell, practically all members of our Board and many Local Section officers have come forward with either written or verbal comment concerning desirable increased Society activities which call for increased financial support. It is worthy of special comment that not a single suggestion has been received which could be classed as revolutionary or radically different from those activities already in effect and financially supported by our Society. It is considered commendable that every suggestion and comment has tended toward conserving our strength and past gains, and going forward with expanded programs in those directions which have proven most important and beneficial to our membership in recent years.

Four fields of activity were discussed most pointedly among all the suggestions submitted. One was the need for greater and more effective activity at the Local Section level, with increased financial support from the parent Society to aid such activity. This includes increased activity by both the Junior Members and the older members. Secondly, were requests for more visits to the Local Sections from the headquarters staff and the elected officers, so that greater knowledge of Society affairs could be brought to the individual member, and greater stimulus be given to Local Section activity thereby.

As could well be expected in view of our Society's historic and impregnable position in the field of technical publications, the third general demand was for universal support for an expanded and strengthened publication program. It was urged that continued and greater support be given to the publication of technical writings in the civil engineering field and that these writings be made more readily and fully available to our members and thus to the whole profession.

The fourth field of activity for which increased support was requested almost universally was in respect to our students, particularly through our Student Chapters. The desire of the older engineer always to foster and improve the lot of the younger engineer is an excellent demonstration of our true professional concepts, and gives complete promise of our ever-advancing status.

Other activities for which strong support was requested was in respect to what we call Conditions of Practice. There is a strong demand that all our members be kept advised of the latest developments in respect to employment conditions, salaries, engineering education, national affairs, possible unionization, cooperative effort with other engineering societies, and all similar matters pertaining to professional rather than purely technical advancement. Happily, practically all our members appear to see eye to eye on all these matters, whether employee or employer, and whether in public service or private organizations. Through the years our Society has always stood for professional and technical excellence and advancement. Our foundation has been on solid rock and we have endured.

A strong demand was expressed for an increase in the work of our Technical Divisions. Clear appreciation was expressed of our fine magazine, CIVIL ENGINEERING, with the request that this publication be expanded.

Another heartening request, repeated by several, was that we conserve our financial resources as fully as possible and establish financial strength for our Society which will enable it to survive temporary setbacks.

In the April 1953 issue of CIVIL ENGINEERING there was an excellent article pertaining to the income of the Society, the need for additional funds in the amount of about $145,000 annually, and listing the new activities and new supports which then appeared most desirable. A

member of our Committee, S. T. Harding, has again reviewed that article. Mr. Harding calls attention to the fact that the proposed budget for 1955 shows an increase in income from dues of about $140,000 over the actual income for 1954, and that in the 1954 budget and the proposed 1955 budget, all the activities listed as desirable in the 1953 article in CIVIL ENGINEERING have now been cared for.

One request made on several occasions has been that the Society should return to the old plan of distributing Proceedings on a monthly basis free to all members. The present plan for Proceedings-Separates makes it possible for each member to obtain all such papers he can reasonably use, greatly increases the variety and number of papers issued, all at greatly reduced cost to the Society. Another member of our committee, Frank A. Marston, is also chairman of our Publications Committee. Mr. Marston advises that next year 300 papers will be issued, comprising about 6,600 pages of Proceedings-Separates. If 25 such papers were issued each month to every member, each monthly package would contain the indigestible total of 550 pages of technical writing, and the estimated cost of such free distribution to all members would approximate $370,000 for the year, $282,000 more than allowed for this item in the proposed 1955 budget, exclusive of staff salaries. The present plan of 100 selected Proceedings-Separates free annually to each member with his automatic receipt of the papers of his chosen Technical Division is clearly a liberal and more reasonable plan.

It is also interesting to note that the free distribution of TRANSACTIONS to all our members would increase our budget for 1955 on this item by about $78,000. The free distribution of our Directory to all our members on an annual basis would increase the cost of this operation by about $32,000. These policies of free distribution were in effect several years ago but the present methods and procedures are clearly more efficient and economical, and the Society members are better served. An interesting tabulation to support the preceding statements appears in Table I.

In preparing the proposed budget for 1955, every field of advice and information was explored. In addition to the suggestions which came through the Directors as a result of the appeal of President Terrell, all Technical, Administrative and Professional Committees or Divisions submitted their requests for funds based on their expected needs and proposed activities. These were received and examined sympathetically, with the result that practically every justified request was granted. As usual, the staff at Society Headquarters did an outstanding job of working with the Budget Committee. George Burpee served as a rather special member of our Committee and gave the benefit of his previous years of experience on this Committee work. President Terrell sat in on our final Committee session and was of very great assistance in all particulars.

Without attempting to review all the details of the proposed budget for 1955, we consider it very important to emphasize certain features. Any specific questions which may be asked will be answered. In respect to income from dues, it is notable that the 1955 budget shows an increase of $139,100 over the estimated actual receipts for 1954. It should be noted also that there is a drop in income in the sale of publications which amounts to $25,000. This is almost wholly accounted for by the practical elimination of receipts from the sale of Centennial TRANSACTIONS. The other detailed figures which comprise the estimated total income for the Society in 1955 speak for themselves.

It is believed that adequate allowance in the 1955 budget has been made for increased travel by key members of the Headquarters staff and elected officers. This is in line with the expressed desire for closer contact between our Local Sections and their members with our Headquarters staff and officers, as well as for other essential official travel.

In respect to professional activities, the 1955 budget makes provision for an increased expenditure of about $10,200 over the actual expenditures for 1954. In addition to meeting all the requests of the different committees which come under this heading for increased allotments, an increase has been made in the allotment of salaries of the Headquarters staff to this activity, and an addition of an item of $4,000 has been made available for specific publications which may be considered particularly beneficial in this field.

In response to the strong demand which was indicated for greater financial support for our Local Sections and activities at local levels, the budget for 1955 shows an increase of approximately $32,200 over the actual expenditures estimated for 1954. The greater portion of this increase is accounted for under the new formula proposed for allotments to the Local Sections and Branches. This formula provides lump-sum payments of $50 to each Local Section, with an additional $50 each to the Branch or Subsection of each Local Section. In addition, an allotment is to be made to each Local Section corresponding to $25 for each Student Chapter under the jurisdiction of the Local Section. Finally, the amount which is to be returned to each Local Section for each member who pays dues to the Local Section has been increased from one dollar to two dollars. This last increase accounts for approximately $17,500 of the total increase for Local Section activities in the 1955 budget over the actual expenditures for 1954.

An increase of approximately $1,800 is made for prospective visits of the Directors

TABLE I. *Transactions, Proceedings, Year Book*—comparative costs

Comparative costs of present and former systems of distribution—if former systems of distribution were applied to present publications program

	TRANSACTIONS	PROCEEDINGS	YEAR BOOK	TOTAL
Present system:				
Production and distribution	$ 80,700	$102,500	$23,000	$206,200
Income	56,500	20,000	....	76,500
Net cost	$ 24,200	$ 82,500	$23,000	$129,700
Reinstalling former system:				
Production and distribution	$125,000	$370,000	$55,000	$550,000
Income	23,000	15,000	....	38,000
Net cost	$102,000	$355,000	$55,000	$512,000

Yearbook:

Present distribution: Sent free on request.
Former distribution: Sent free to entire membership.

Transactions:

Present distribution, standing orders: $4.00 for Morocco grain, $3.00 for cloth, $2.00 for paper.
Former distribution: $2.00 for Morocco grain, $1.00 for cloth, no charge for paper (paper-bound volumes sent to all members not receiving Morocco grain or cloth volumes).

Proceedings:

Present distribution: One Technical Division free, based on enrollment, in addition, 100 free issues through choice.
Former distribution: All issues to entire membership without charge.

Recapitulation

Estimated Net Cost of former system of production and distribution	$512,000
Estimated Net Cost of present system of production and distribution	129,700
Estimated increased costs of changeover to former system	$383,300

of the Society to their Local Sections. An increase of approximately $4,400 is made for Local Section conference mileage. It is pertinent to note that there will be three Local Section conferences next year instead of two as heretofore, such conferences being scheduled at San Diego, St. Louis, and Hartford. The $10,200 budgeted for this activity includes provision for the attendance of one Junior Member from each Local Section in addition to its other representatives, as presently authorized.

The increase directly budgeted to Student Chapters is supplemented materially through allotment to the Local Sections because of Student Chapters, as noted in the preceding paragraph. A substantial portion of the increased allotments for Student Chapters is expected to produce more visits to the Chapters by the officers of the Society and the Local Sections and by key personnel from staff Headquarters. A substantially increased allotment has been made for Faculty Adviser conferences in keeping with the demand which has been indicated for such conferences.

It is to be noted that the 1955 budget makes full provision for a contribution of $35,000 to the retirement system, in keeping with the special report and recommendation of the Administrative Advisory Committee with regard to our future retirement system, which has recently been adopted by the Board of Direction.

There has been a definite expression of desire that salaries at staff Headquarters be adjusted to accord with current living costs and that provision be made to provide greater staff activity pertaining to Local Section visits. The 1955 budget is set up to provide for the required additional staff, such adjustments as may become necessary through the retirement of the present Executive Secretary, and finally, to provide an appropriate overall adjustment of salaries in 1954.

Separately, our Committee is making written recommendation that our Bylaws be amended to authorize the appropriate payments for Local Sections, Branches, and Student Chapters for which this budget makes provision.

Our Committee believes that it has produced a well-rounded and balanced budget for 1955 for your approval. We believe it is in keeping with the program of progress which our Society members have indicated as necessary and which they have made possible through their approval of an increase in dues. It is now moved that this proposed budget for 1955, attached, be adopted.

Respectfully submitted,

Frank A. Marston
S. T. Harding
George W. Burpee
Enoch R. Needles, *Chairman*

W. H. Wisely to Succeed W. N. Carey as ASCE Executive Secretary

Selection of W. H. Wisely, M. ASCE, of Champaign, Ill., to succeed W. N. Carey as Executive Secretary of ASCE was confirmed by the Board of Direction at its October meeting. As reported previously in CIVIL ENGINEERING, Mr. Carey asked the Board last January to permit him to go on a retirement status. In accordance with the recent Board of Direction action, Mr. Carey will retire as Secretary on May 1, 1955, and be Secretary Emeritus. Mr. Wisely will become a member of the Headquarters staff as Associate Secretary about January 1, 1955, and will have four months to become familiar with the job of ASCE Secretary before Mr. Carey leaves.

Mr. Wisely is forty-eight. He was born in Illinois and holds BS in CE (1928) and CE (1941) degrees from the University of Illinois. His work has been principally in the sanitary engineering field. He comes to ASCE from the Federation of Sewage and Industrial Wastes Associations, where he is executive secretary and editor of the journal published by that association, *Sewage and Industrial Wastes*.

Hoover Medal Awarded to Alfred P. Sloan, Jr.

Presentation of the Hoover Medal to Alfred P. Sloan, Jr., New York engineer and philanthropist, was a feature of the annual dinner of the American Institute of Consulting Engineers held in New York on October 19. Mr. Sloan, chairman of the board of General Motors and fifteenth recipient of the medal, was cited as "Engineer, builder of vast industry; friendly coordinator of management and labor; generous supporter of research in economics, education, and medicine; eminent citizen, exemplifying the finest tradition of American free enterprise."

A graduate of Massachusetts Institute of Technology, Mr. Sloan was president and general manager of the Hyatt Roller Bearing Co. from 1897 to 1916, and president of the United Motors Corp. from 1916 to 1919. Since the latter year he has been with General Motors, which he has served as director, vice-president, and president. He has been chairman of the board since 1937. Mr. Sloan's humanitarian activities have been centered in the Alfred P. Sloan Foundation, Inc., of which he is president and to which he has contributed upwards of $10,000,000. Foremost in size and importance among the grants made by the Foundation was a grant of $4,000,000 to Memorial Hospital for the establishment and partial maintenance of the Sloan-Kettering Institute for Cancer Research.

The Hoover Medal, which was established in 1929 to commemorate the civic and humanitarian achievements of Herbert Hoover, Hon. M. ASCE, is awarded "by engineers to a fellow engineer for distinguished public service." Mr. Hoover was the other guest of honor at the AICE dinner, where he received the organization's Award of Merit.

John Fritz Medal Goes to Electrical Engineer

Award of the John Fritz Medal for 1955 to Harry Alonzo Winne, electrical engineer and member of the AIEE, is announced by the John Fritz Medal Board of Award. Mr. Winne is cited as "Engineer, industrial statesman, for service to his country in war and peace through his distinguished leadership in the electrical industry." He will receive the medal during the winter meeting of the AIEE.

In 1910, following his graduation from Syracuse University, Mr. Winne began a long and distinguished career with General Electric, where he rose through the ranks to become vice-president of engineering policy. Mr. Winne's early work with electrical precipitation, design of electric furnaces, and pioneering contributions to steel mill electrification (he holds 13 patents) has been overshadowed recently by his position as an industrial authority on atomic energy. In 1946 Secretary of State Byrnes named him one of five consultants to the Committee on Atomic Energy to formulate proposals for the control of atomic power. He also served as chairman of the advisory committee on the Hanford Works. For several years Mr. Winne has been on the Scientific Manpower Advisory Committee of the National Security Resources Board and on the Committee on Specialized Personnel of the Office of Defense Mobilization.

The John Fritz Medal was established in 1902 by professional associates and friends of the late John Fritz, Hon. M. ASCE, to perpetuate the memory of his achievements in industrial progress. It is administered by a sixteen-engineer board representing the four Founder Societies.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

Engineers with funds to invest were offered encouragement and advice in the leading talk at the **Buffalo Section's** September luncheon meeting. The speaker—Howard H. Roth, partner in the New York investment brokerage firm of Merrill, Lynch, Pierce, Fenner & Beane—pointed out that engineering is a wonderful background for any business whatsoever. With "the handling of investments becoming more and more commonplace," Mr. Roth suggested three sound rules for investors: (1) Objectivity, i.e., the investments must be planned with a definite purpose in mind; (2) flexibility, i.e., the investor must have an open mind to recognize changes in economic structure as they occur; and (3) selectivity, i.e., making reasonable separation of investments and diversifiying risks.

With the mayor and water commissioner of Decatur as guests, the **Central Illinois Section** devoted a recent dinner meeting to discussion of the Decatur water supply. The featured speaker was Arthur P. Geuss, chief engineer of the Harza Engineering Co., who described the engineering problems involved in raising the level of Decatur Dam—a project that is expected to provide the city with an adequate water supply for the next twenty years.

An inspection tour of the new Eugene Talmadge Memorial Bridge at Augusta, Ga., initiated the fall program of the **Georgia Section's Savannah River Valley Subsection** on September 23. The trip was conducted by Ralph A. Bennett, member of the Subsection and engineer of the George A. Fuller Construction Co., assisted by C. B. Hudgins and F. J. Maynard. At a dinner meeting concluding the program, Larry O. Tessier was elected secretary-treasurer to fill the vacancy caused by the resignation of O. K. Albright.

ASCE President Daniel V. Terrell gave an informative address on the Society at the **Kansas Section's** September 17 dinner meeting, which was Ladies' Night. His talk covered finances and other current issues.

Activities of the **Metropolitan Section** got under way a month earlier than usual this fall, with September 15 the date of the first meeting. There was lively discussion of the topic of the evening, "Problems of Unionization and Collective Bargaining as They Affect Professional People," with both employers and employees expressing themselves frankly. The principal speakers were Charles W. Yoder, Milwaukee engineer and vice-chairman of the Society's Committee on Employment Conditions, and Gerard D. Reilly, Washington, D.C., specialist in labor relations. ASCE Assistant Secretary E. Lawrence Chandler was moderator of the session. A change in the roster of Section officers elected last June is necessitated by the fact that Secretary Frank Mirgain has left New York to become dean of engineering at North Dakota Agricultural College. Succeeding him as secretary is Arthur Fox, of *Engineering News-Record*.

Members of the **Vicksburg Branch** of the **Mid-South Section** heard Gen. John R. Hardin, president of the Mississippi River Commission, discuss the Mississippi-Atchafalaya River diversion problem at a recent luncheon meeting.

Civil and military engineers got together in September for a two-day conference combining the semiannual meeting of the Society of American Military Engineers and the annual District 7 conference of ASCE Sections. Hosts for the joint program, which was held in St. Paul, were the **Northwest Section** and the Minneapolis-St. Paul Post of the SAME. At the convention dinner Brig. Gen. William E. Potter, division engineer for the Missouri River Division of the Corps of Engineers, spoke on "The Economic Importance of Water Resources Development in the North Central States"—one of a number of papers on the engineering development of the area which, along with reviews of the military construction program, made up the program. Also on the agenda were visits to the St. Anthony Falls Hydraulic Laboratory and the experimental taconite plants in northern Minnesota. Carl T. Nordstrom was chairman for the Section and E. J. Hurley for the SAME.

P. C. Livesay (left), general superintendent of the Sugar Creek Refinery of the Standard Oil Co., is greeted by Richard R. Tipton, president of the Kansas City Section as he arrives to address the Section's first meeting of the new season. There was a turnout of 143 to hear Mr. Livesay, who spoke on "Oil's Place in Our Economy."

Distribution and sale of power from hydroelectric peaking plants in the Southwestern Power Administration system was outlined by Walter G. Burnham, hydraulic engineer for the SPA, in a leading paper given at the **Oklahoma Section's** annual fall meeting held at the University of Tulsa, October 1. The speaker, Walter G. Burnham, hydraulic engineer for the SPA pointed out that the dams in the circuit—Denison, Fort Gibson, and Tenkiller in Oklahoma and Norfork and Bull Shoals in Arkansas—are multiple-purpose projects, with flood control their primary function, but that the manufacture and sale of power is their principal source of income. The state's long-range water program was discussed by Fred G. Fellows, Ponca City consultant, and its small surface water supplies by Salim Youseff Ashi, of Beirut, Lebanon. John A. Short, field representative of the U. S. Department of Agriculture spoke on "The Small Watersheds Protection Act"; L. W. Bremser, Kansas City, Mo., consultant, on Tulsa's new municipal treatment plant; and William J. Fell, Tulsa consultant, on registration.

Two of the **Sacramento Section's Subsections**—**Nevada** and **Central Valley**—sponsored a recent two-day field trip to the Anaconda copper mine at Yerington, Nev., to which the entire Section was invited. Some forty members and their families made the trip, which included visits to the Leviathen sulfur mine northeast of Markleeville and ceremonies and a barbecue connected with the opening of the final link in the "East of the Sierras Highway," as well as the copper operation at Yerington.

The probable growth and development of San Diego County in the next decade was outlined by Jack Beardwood, of Welton Bechet & Associates, at a recent meeting of the **San Diego Section.** Mr. Beardwood also discussed the architectural and engineering potential of the area, basing his forecast on a survey recently

Scheduled ASCE Conventions

SAN DIEGO CONVENTION
San Diego, Calif.
Hotel U. S. Grant
February 6–11, 1955

ST. LOUIS CONVENTION
St. Louis, Mo.
Jefferson Hotel
June 13–17, 1955

NEW YORK CONVENTION
New York, N.Y.
Hotel Statler
October 24–28, 1955

made by his firm. ASCE Director M. J. Shelton reported on current Society business.

A talk on problems involved in design and construction of the Prudential Life Insurance Building, which is being erected over the Illinois Central Railroad tracks in downtown Chicago, drew a large attendance for the **Wisconsin Section's** first meeting of the season. The guest speaker was J. P. Roche, chief structural engineer of Naess & Murphy, architects and engineers of Chicago.

Texas Section Holds Fall Meeting in Houston

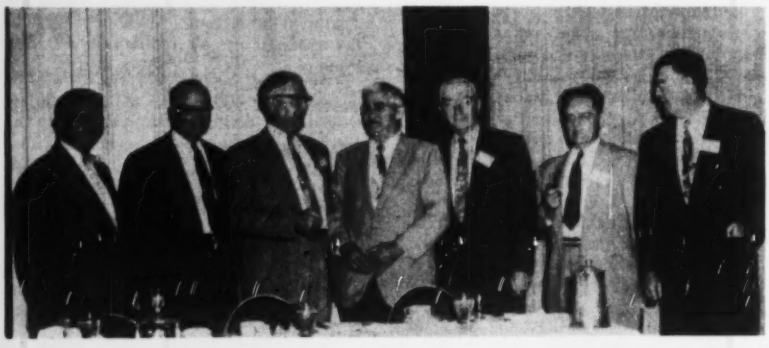
The Texas Section's fall meeting—held in Houston, September 23-25, with the Houston Branch as host and Lowber D. Snow as chairman—was reported a great success. Activities got off to a good start on Thursday, the 23rd, with a boat trip down the Houston ship channel, which gave an opportunity to see the many industries lining the shores by day and the beautiful night lighting on the return trip. Featured speakers included Walter M. Casey, economist, sales analyst, and lecturer of Beaumont, who spoke Friday morning, and ASCE President Daniel V. Terrell, who addressed the men's luncheon that noon.

Three Friday afternoon technical sessions running concurrently produced interesting papers on soil mechanics, river hydraulics, and structural and construction subjects. Speakers included W. C. Dodd, of the Engineers Testing Laboratory, Houston; Bramlette McClelland, Houston consultant; Wayne Dunlap, student at Texas A & M College; S. W. Freese, Fort Worth consultant; R. L. Lowry, consulting engineer of Austin; L. A. Loggins, of the Southern Pacific Lines at Houston; George Rackle, of George Rackle and Sons Co., Houston; Aaron J. Cohen, of H. E. Bovay, Jr., Consulting Engineers, Houston; R. L. Reid, structural engineer, of Houston; E. A. Kruse, of the Tellepsen Construction Co., Houston; Jack A. Allison, of Farnsworth & Chambers, Houston; and L. H. Durst, of Brown & Root, Houston.

John A. Focht, Sr., congratulates Honorary Texan Terrell, complete with the new Stetson hat he received at the Friday luncheon. Dean Terrell received his certificate of honorary citizenship in the state at the Student Breakfast on Saturday.

At the business meeting Saturday morning Robert L. Lowry, of Austin, was installed as president, and I. W. Santry, of Southern Methodist University, as vice-president.

The Texas Conference of Student Chapters met Friday afternoon and at a Saturday Student Breakfast. Calvin Wood, of the University of Houston, presided, and Allen P. Richmond, Assistant to the Secretary of ASCE, gave a talk on collective bargaining. At the conclusion of the meeting, Mr. Lowry and Mr. Richmond supplemented the work of the conference with a three-day motor tour of the six Student Chapters in Texas colleges. On the trip they met and talked with some 270 students whom they helped make plans for the new school year.



Attending the fall meeting of the Texas Section in Houston are (left to right) Allen P. Richmond, Assistant to the Executive Secretary of ASCE, New York, who addressed the Texas Conference of Student Chapters held during the meeting; Robert L. Lowry, newly elected president of the Section; Randle Alexander, immediate past-president of the Section; ASCE President Daniel V. Terrell; Robert J. Cummins, newly elected Honorary Member of the Society; Raymon Dawson, ASCE Director for District 15; and Robert A. Rait, president of the Houston Branch.

Coming Events

Arizona—Annual Joint Engineers' Meeting at Phoenix, Ariz., November 12 and 13. The Section will meet at the Hotel Adams in Phoenix all day Nov. 13.

Cincinnati—Meeting at the Engineering Societies Building, December 1, 8 p.m.

Illinois—Weekly luncheon meetings featuring ten-minute speeches, at the Chicago Engineers Club, 314 South Federal St., every Friday at 12 noon.

Iowa—All-day annual meeting at the Hotel Fort Des Moines, Des Moines, November 18.

Los Angeles—Soil Mechanics Group will meet on November 17. Call Chairman Fred J. Converse at Sy 6-7121 or Ry 1-7171 for information about meeting place. The November and December meetings of the Sanitary Group will be combined in the annual Christmas Meeting, at the Hotel Clark, December 1.

Metropolitan—Meeting in the auditorium, Engineering Societies Building, 33 West 39th St., November 17, 7 p.m. Meeting of the Junior Branch in the Engineering Societies Building, November 10, 7 p.m.

New Mexico—Fall meeting in Santa Fe, December 9-11. The ASCE Executive Committee will meet during this session. Information from Secretary-Treasurer Rufus H. Carter, Jr., 3126 12th St., N.W., Albuquerque, N. Mex.

Oklahoma—Annual meeting at Stillwater, Okla., November 27.

Philadelphia—Dinner meeting in the auditorium of the Philadelphia Engineers' Club, November 9, 6:30 p.m. Joint meeting with ASME as hosts, at the Hotel Sylvania, December 6.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

Tennessee Valley—Annual meeting at the Hotel Patten, Chattanooga, Tenn., November 5 and 6. Program features inspection trip of Chattanooga Division plant of Combustion Engineering, Inc., technical and business sessions, a luncheon, and dinner dance.

ASCE MEMBERSHIP AS OF OCTOBER 8, 1954

Members	8,732
Associate Members	11,156
Junior Members	17,461
Affiliates	69
Honorary Members	44
Total	37,462
(October 9, 1953	36,337)

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Ever since the announcement of President Eisenhower's "grand plan" (August issue, page 79) to modernize the nation's highway system at an estimated cost of $50 billion spread over the next ten years, the topic of highway development has caught the public's fancy. Highway construction is being advocated as an employment stabilizer and as a military need as well as for its usual peacetime transportation function.

Gen. Lucius Clay, Hon. M. ASCE, chairman of President Eisenhower's Advisory Committee on a National Highway Program, called his committee into early action with public hearings in Washington on October 7 and 8. More than twenty national associations presented testimony in this first public hearing, including the leading groups in the highway field.

General Clay gave an inkling of the preliminary thinking of the committee. In the course of his remarks at a press conference held at this same time, he said that the figure of $5 billion a year for ten years over and above all current programs is an absolute top figure and the committee recommendation might be for a somewhat lesser amount. Some new financing scheme will be needed, possibly the establishment of a special government lending agency patterned after the now defunct Reconstruction Finance Corporation. The general aim of the program would be to bring the nation's highway system back to the state of efficiency of 1940 in relation to the amount of traffic and other factors. The war years set it back to its present somewhat deplorable state through shortages of materials and manpower for construction. Some extraordinary program must be undertaken even to regain the state of relative efficiency we had once attained.

This first attempt to translate the President's broad general idea into terms of an operating program gave the associations an opportunity to put into the record their already fairly well known views on highway construction and finance. It has become obvious that highway construction financing is the crux of the matter.

Basic data before the committee include the results of the highway survey made by state highway officials and recently compiled by the Bureau of Public Roads. According to the survey, it is estimated that $101 billion of highway improvements are now needed during the next decade as compared with previous estimates of $45 billion. The increased figure reflects in part some increased costs, inclusion of a much more comprehensive estimate than ever before of urban road needs as well as estimated needs on the primary federal-aid system based on current improved standards. The new survey was made on the basis of building the interstate system to meet estimated 1974 traffic needs, this "raising of the sights" accounting for about $8 billion of the increased total reported in the survey.

The new Federal-Aid Highway Act of 1954 (P.L. 350) brings the expenditures of the Federal Government for highways more nearly in line with Federal responsibilities in this field, with a total authorization of $875 million for each of the next two fiscal years.

The Clay Committee expects to report to the President by the end of the year. It has asked various associations to submit information before this date on the capacity of the construction and equipment industries and to furnish other data necessary for the formulation of a program.

Among the organizations submitting testimony and reports to the committee were the American Association of State Highway Officials, American Road Builders Association, Associated General Contractors, and the Automobile Manufacturers Association.

The AASHO spokesman contended that only by finishing the 40,000-mile interstate system 100 percent by the federal government could it be built in a reasonable time and to adequate standards in all the states. He also mentioned that state highway departments had difficulty in obtaining engineers owing to the salary situation, but hoped that it might be corrected soon. He suggested that the services of consulting engineering firms might be resorted to more frequently.

The Associated General Contractors expressed the belief that contractors' capacity could be doubled in two years, that unit prices were low, that competition was keen with recent bids generally 10% below engineers estimates.

The American Road Builders Association urged relaxing of laws to permit federal participation in toll-road construction. It also argued for extension of federal credit to assist states in financing highway construction, through loans to be retired during a period not longer than the useful life of the road.

The Automobile Manufacturers Association supported the President's proposal and recommended setting aside adequate funds for research on materials and engineering specifications, and on the effect of highway designs and traffic engineering features on driver behavior.

The leading farm organizations were less enthusiastic for the proposal and are opposed to suggested limitations of federal aid to the primary system. An economist for the National Grange indicated that increasing gasoline taxes $5 billion a year might require an increase of the present 8-cent average tax to 21 cents a gallon. He suggested that general revenues would have to be used for highway construction or our bonded indebtedness greatly increased.

The American Petroleum Institute expressed surprise at the estimated $101 billion highway need as reported in the latest Bureau of Public Roads survey. The Association of American Railroads reiterated its well known position that highways should be self supporting on the basis of user charges, and that states should not be relieved of the necessity of protecting highway facilities against abuse by heavy freight vehicles through undue federal grants-in-aid for highways. It urged giving more responsibility to the states with no more than a minimum of federal participation.

Most groups want to obtain as much as possible of the benefits from such a highway program and to bear as little as possible of the burden. Civil engineers whose professional engagements call for applying the principles of engineering economics to proposed highway developments are one of the group most competent to furnish expert and unbiased views to the committees who will decide the fate of proposals for a new approach to highway development.

Washington, D. C.
October 15, 1954

NEWS BRIEFS . . .

Another Record Building Year Predicted for 1955

Construction expenditures next year will reach a new peak record of almost $39 billion—an increase of about 5 percent, or almost $2 billion, over this year's unprecedented outlays. This prediction, one of the first authoritative industrial forecasts ventured for 1955, is made by Miles L. Colean, Washington construction economist and consultant to the Mortgage Bankers Association of America and other industrial groups.

Writing in the September issue of *Architectural Forum*, Mr. Colean comments that no other major industry has provided such a strong prop to the economy of the country or shown the strength or growth displayed by construction this year. It "has once again confounded the prophets of gloom, amazed the skeptics, and surprised even the optimists," he says. "If construction can be so vigorously sustained in a recession year, it is bound to grow in a period when the forces of economic expansion are again asserting themselves. Next year is sure to be another boom year, almost certainly a year of higher expenditures than 1954, with a probability of reaching a total close to $39 billion."

According to the forecast, private construction outlays will go up about $1 billion next year, a gain of 4 percent over this year. Government spending for construction is expected to increase about $900 million, an 8 percent advance. Mr. Colean predicts that, in private construction, residential building (mainly new single-family houses) will account for most of the increased expenditures. In other categories, contraction and construction will pretty much offset each other.

A continued decline in private industrial construction is expected, although the decline will be less than the drop from 1953 to 1954. Commercial construction, however, will continue to rise, although the rate of expansion will slacken. Warehouse, office, and loft building is expected to advance another 15 percent.

In public construction, Mr. Colean predicts that next year highway building will increase about $1 billion, or 25 percent. Public school building will go up about $150 million, or 7 percent. Public hospital and institutional construction will increase only slightly, and four government categories will probably show declines—public housing, industrial (atomic energy) construction, conservation and development, and miscellaneous public service building.

As factors tending to intensify the demand for new housing, schools, hospitals and recreational facilities, and indirectly contributing to a higher rate of industrial, commercial, and public construction, Mr. Colean lists the continued high birth rate and lowering of the death rate; the continued growth of personal income; the upward shift in average income; the increasing propensity to spend; and increased security in old age, permitting older members of the community to remain active participants in the market. He also lists "stimulative influences" for increased production provided by the federal government, including the easy money policies of the Treasury and the Federal Reserve; the liberalized depreciation regulations in the new tax law; the easier home-purchase terms in the new housing act; and the new "lease-purchase" program for the construction of post offices and other federal structures.

More Colorado River Water for San Diego

Colorado River water is now flowing through both sides of the 71-mile San Diego County Aqueduct, bringing the full capacity of the installation to 140 mgd and providing water for some 1.2 million persons. Two years in construction, the $16,400,000 second barrel was placed in operation in recent ceremonies conducted at the Oat Hills Tunnel north of Escondido.

In the early 1940's the City and County of San Diego obtained rights to 112,000 acre-ft of Colorado River water. To utilize this supply required building a pipeline south from the Metropolitan Water District's aqueduct at San Jacinto. The first barrel, which cost $14,000,000 and was finished in 1947, began as a Navy project to supply San Diego wartime installations. When the war ended the city took over, and state legislation provided for formation of the San Diego County Water Authority.

The Bureau of Reclamation designed the barrels, which were financed and built by the Navy. Richard S. Holmgren, M. ASCE, is chief engineer of the San Diego County Water Authority.

The barrel starts at the San Vincente Reservoir and runs south for 71.1 miles, with 75, 60, 54, and 48-in.-dia concrete-steel ringed pipe. The pipe is 16 ft deep in some sections.

Ten-Mile Savannah River Bridge Project Is Dedicated

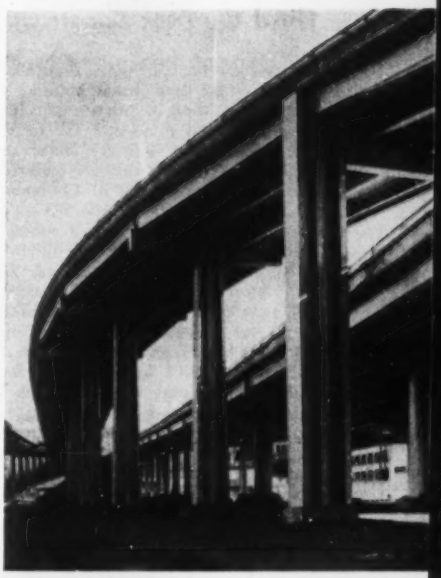
Georgia's new high-level Eugene Talmadge Memorial Bridge across the Savannah River at Savannah—providing a six-mile short-cut on the north-south Route 17 between South Carolina and Georgia—was formally dedicated on October 15. Governor Herman Talmadge of Georgia, son of the late governor for whom the bridge was named, was the principal speaker at the ceremony, which was attended by public officials from a number of Southern states.

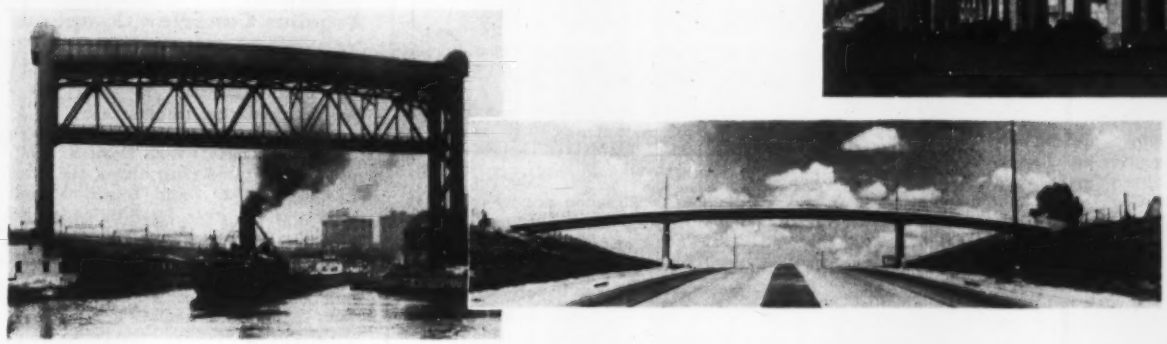
The 6,034-ft cantilever crossing providing 135 ft of vertical clearance over the 400-ft-wide channel is the key feature of a ten-mile $14,600,000 project that bypasses the congested industrial area of Savannah. The project includes about nine miles of low-level trestle bridge, causeways, and approach roads.

The project was constructed for the Coastal Highway District of Georgia by the Merritt-Chapman & Scott Corp., as the prime contractor, with Parsons, Brinckerhoff, Hall & Macdonald serving as consulting engineers. The superstructure of the bridge was erected by the American Bridge Division of the United States Steel Corp.

AISC Awards Prizes for Beautiful Bridges Opened to Traffic in 1953

Three top winners in the American Institute of Steel Construction's 26th annual competition for aesthetic steel bridges are shown here. Seen at the right is the Ninth and Tenth Street connection of the Bayshore Freeway, San Francisco, winner in Class II, for bridges with spans under 400 ft costing over $500,000. The structure, acclaimed as "the most imaginative entry," was designed for the state by the Bridge Department of the California Division of Highways and fabricated by the Bethlehem Pacific Coast Steel Corp. In Class III (for bridges with fixed spans under 400 ft and costing less than $500,000) the prize went to the Robert Street Pedestrian Underpass over South Freeway, Fort Worth, Tex. (lower right), owned and designed by the Texas Highway Department and fabricated by the North Texas Steel Co., Inc.; and in Class IV (for movable bridges) to New York Central Railroad Bridge No. 8 over the Cuyahoga River, Cleveland (lower left), owned by the New York Central, designed by Howard, Needles, Tammen & Bergendoff, and fabricated by the Mount Vernon Bridge Co. This year no top award was made in Class I, comprising bridges with spans of 400 ft or more and costing over $500,000.





ARBA Discusses Interagency Cooperation at County Officials Meeting

Achieving good state-county-township relationships is a problem that has long been recognized by road builders. It is a problem requiring continuing study, and this it was given at the recent National Highway Conference of County Engineers and Officials of the American Road Builders Association at Columbus, Ohio. The problem was clearly stated by O. L. Hagen, of the North Dakota State Highway Department, in his paper, "State-County Relationships in Highway Administration."

Mr. Hagen stated, "We recognize the need for improved relations. We realize that the success of the highway program on any of the several systems of the state is predicated on desirable and effective governmental relations between state, county, and city. However, in spite of all that has been said and written we have yet to develop a motivating force that will bring together the several governmental units with similar problems, that can be resolved into practical coordinated plans. The general approach is through single-handed action without consultation of the other groups. Sometimes one group takes action that does not particularly benefit it, but does much to destroy the accomplishments of others."

The success of Wisconsin in developing workable legislation along this line was related by W. L. Haas, of the Wisconsin State Highway Commission. Also of importance to the taxpayer in getting the most for his money is a proper relationship between the county engineer and the contractor. In discussing this phase of roadbuilding E. N. Rodgers, engineer-manager of the Alabama Road Builders Association, concluded that "To secure the maximum value for the construction dollar for the taxpayer, continuing periodical joint study by awarding authorities and contractors should be encouraged with the prospect that (1) specifications can take advantage of machinery improvements as construction operations become more highly mechanized; (2) design standards can be adhered to as closely as possible and for as long a period as feasible so that contractors can standardize on equipment, thereby avoiding unnecessary expense and job cost; and (3) substantial ease in operating procedures and reductions in cost can be made without impairment of quality through design and specifications, which for example, eliminate handwork, permit re-use of forms, avoid unnecessary rubbing of concrete, permit standardized compaction of fills and others."

One of the principal speakers of the conference was the Hon. J. Harry McGregor, chairman of the Subcommittee on Roads of the House Committee on Public Works. In speaking of the present administration's highway program, he declared, "You will experience a greater decentralization of federal authority but you will also assume added responsibilities involving acts of judgment which should, at all times, reflect the highest type of sound public administration. You will need to establish or improve your engineering and administrative services, and it will be wise for you to take advantage of the contract method wherever feasible in carrying out the enormous programs that lie ahead."

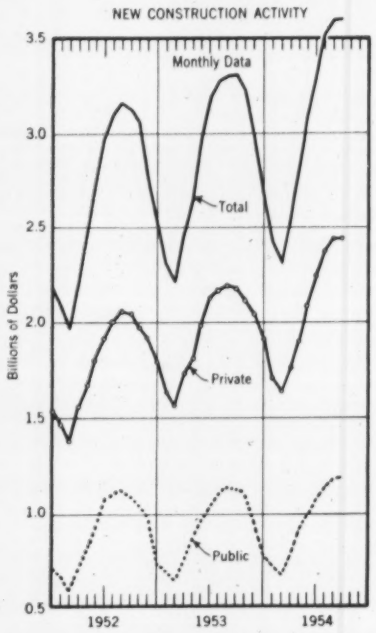
Third-Quarter Construction Outlays Reach New High

New construction activity in September matched the all-time peak volume of $3.6 billion achieved in August to round out the most active quarter on record for the construction industry, according to preliminary joint estimates prepared by the U.S. Departments of Commerce and Labor. The value of new work put in place during the past month brought the third-quarter total to $10 3/4 billion—7 percent above the July-September 1953 period. After adjustment for seasonal factors, new construction activity in the third quarter of 1954 was at an annual rate of $37.5 billion, as compared with an annual rate of $36.3 billion in the first half of the year and actual outlays of $35.3 billion in 1953.

Private residential building continued at a near-record level in September, edging up to $1.3 billion. Over $3.8 billion of new residential building was put in place from July through September—an increase of 15 percent over outlays for the third quarter of last year. Private industrial building activity held steady in September, following an almost continuous decline since early 1953. Third-quarter industrial building volume was 9 percent less than last year.

Commercial building continued at a record-breaking rate in September, exceeding the $200,000,000 mark for the third consecutive month. Religious and private educational building showed more new work put in place in September than in any previous month on record.

State and local public construction continued to expand in September to a new high, with new monthly peaks recorded for public school building, highway construction, and sewer and water facility work. The value of work installed for these three important public-works types accounted for three-fifths of total public-construction expenditures in the quarter just ended, and was 13 percent above the third quarter 1953 rate. Federal construction activity in September—notably defense construction and conservation and development work—remained well under the levels of a year ago.



September construction activity continues at the record rate of $3.6 billion established in August to round out the industry's highest quarter on record. The high level is shown in Commerce Department curves.

Total construction activity during the first nine months of 1954 amounted to $27.4 billion—a new record for the period and 4 percent above the same months in 1953. Private outlays, at $18.8 billion, were 6 percent higher than in the January-September 1953 period. Public expenditures of $8.6 billion for new construction through September were about the same as for the corresponding 1953 period.

AEC Authorizes New Power Reactor Study

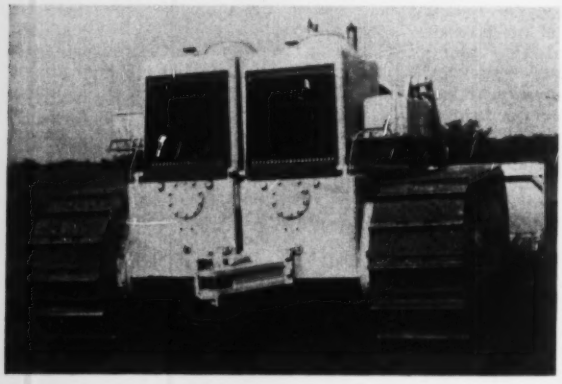
The U.S. Atomic Energy Commission has authorized the Pennsylvania Power and Light Co., of Allentown, Pa., to make a nuclear power study—the fifteenth to be undertaken under the Commission's industrial participation program. Under the terms of a one-year agreement, the Pennsylvania Power and Light Co. will make a detailed study at its own expense of the economic and engineering feasibility of a large-scale, nuclear-fueled power plant for use in its own system.

Merritt-Chapman & Scott Acquires Canadian Company

In a new step to expand its operations, the Merritt-Chapman & Scott Corp. has acquired the Toronto-based C. A. Pitts General Contractor, Ltd., according to an announcement from Louis E. Wolfson, president and chairman of the Merritt-Chapman & Scott board. Recent projects of the Pitts organization, which will serve as a Canadian subsidiary for Merritt-Chapman & Scott, include the initial section of the Toronto subway; work on the Queenston, Decew Falls, Des Joachims, and LaCave developments for the Ontario Hydroelectric Power Commission; and major developments for the Aluminum Company of Canada.

Through an exchange of shares Merritt-Chapman & Scott is also acquiring the Marion Power Shovel Co., and its subsidiary, the Osgood Co. The Marion Power Shovel Co. is a leading manufacturer of excavating equipment and cranes, and the Osgood Co. produces a line of smaller power shovels and cranes and operates a foundry business for the manufacture of steel castings.

New Track-Type Tractor Features Twin Diesel Engines and High Horsepower



A twin-engine machine of unusual design marks the entry of the Euclid Division of General Motors into the crawler-tractor market. Recently put through its paces at the GM proving ground at Milford, Mich., the 53,000-lb. experimental model develops a total of 380 hp—twice the power of any similar equipment now on the market. It is powered by two 190-hp, six-cylinder GM Diesel engines, each driving an Allison Torque Converter and Allison Torqmatic Transmission. Each drive train independently powers one track. Final drive gearing is the same job-proved Euclid Planetary used in off-highway 50-ton dump trucks and the 25-yd bottom-dump wagon. Identified as the Model TC-12 Twin Crawler, the new unit is the first of a projected line of twenty tractors to be placed in experimental field service for further testing.

UN-Sponsored Conference On Electric Power in Tokyo

The need for long-range planning of electric power development in predominantly agricultural Asian countries was stressed at a recent five-day conference of experts in Tokyo sponsored by the United Nation's Economic Commission for Asia and the Far East. Top-ranking specialists from sixteen Asian and non-Asian countries as well as observers from several UN-specialized agencies took part in the talks that began October 7.

Delegates urged proper coordination between power development projects and power-consuming industries. Hydroelectric power developments at Maria Cristina Falls in the Philippines and at Sindri and the Mehandi River in India were cited as examples of sound planning. Extensive use of small diesel-engine-driven generating sets was suggested as a means of introducing electricity into rural area. French experts reported satisfactory results with a new design for small, compact hydropower plants.

Nuclear Engineers and Scientists Form Society

A representative group of the 13,000 engineers and scientists engaged full time in government, industrial, and educational aspects of atomic energy activity in the United States met at the National Academy of Sciences in Washington on October 11 to organize a Society of Nuclear Scientists and Engineers (SNSE). One of the principal objectives of the group will be to foster the advancement of nuclear science and technology through the interchange of information and ideas in all fields of research utilizing nuclear techniques. The society expects to serve as a platform for the initial full public discussion of atomic energy technological problems as soon as technical material is declassified under the terms of the new Atomic Energy Act.

SNSE announces that it will hold its first technical conference June 27–29 at Pennsylvania State University, where a "swimming pool" type of nuclear reactor is under construction.

Building Researchers to Study Modular Measure

The building economies afforded by modular measure will be the theme of a conference sponsored by the Building Research Institute. To be held at the National Academy of Sciences on December 9, the all-day session will be the eighth major research conference on better and cheaper building conducted by the Institute. Contractors throughout the country report that modular measure—a simple system of coordinating the designer's dimensions for a building with the actual unit sizes of the materials with which it is to be constructed—is already cutting construction costs.

All interested in the subject are invited to attend the conference, which will be addressed by general contractors, manufacturers, builders, and architects. The nominal admission fee will include a copy of the full conference proceedings, which will be mailed without charge to all registrants.

Wood-Treating Plant Offers Expanded Service

With the completion this fall of a $250,000 expansion program begun in 1952, the pressure-treating plant of Pope & Talbot, Inc., at St. Helens, Oreg., becomes one of the largest wood-treating facilities in the United States. It can supply three types of treatment for Douglas Fir to meet all degrees of exposure from moderate and paintable to severe marine. Poles and piling up to 135 ft long can be handled.

Thin-Walled, Spiral-Weld Pipe Used for Bearing Piles on Thruway Connecting Road

Thin-walled, spiral-weld pipe in 90-ft lengths was driven successfully without mandrel to depths ranging from 116 to 130 ft to serve as bearing piling for land bridge footings for one of five bridges being built at Chester, N. Y., for a new expressway leading to the New York Thruway.

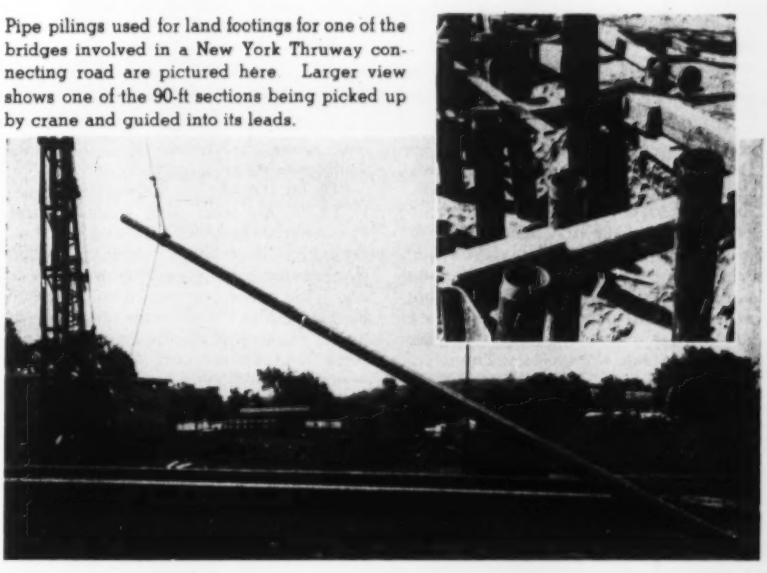
In driving the piles, the contractor (Carlo Bianchi & Co., Inc., of Framingham, Mass.) used a crane equipped with 46-ft leads topped by a Vulcan No. 1 hammer to handle and drive the 90-ft sections of spiral-weld pipe, which were supplied by the L. B. Foster Co. The pipe, conforming to ASTM specifications, has a wall thickness of $^3/_{16}$ in. and an outer diameter of 12 in. Under supervision of New York State Engineers, the piles were driven to refusal—to depths ranging from 20 to 134 ft—without damage or distortion.

In driving the pipe pilings, each 90-ft section—previously fitted with driving points welded into the end of the pipe for efficient penetration—was picked up by the crane and guided into its leads. To achieve the full depth of 125 or 130 ft, a second spiral-weld pipe section 45 ft long was picked up by the crane and placed in position, with the aid of a sleeve insert, into the driven 90-ft pipe piling. The two sections were then welded together, and the extended pipe piling was driven by crane to the required depth.

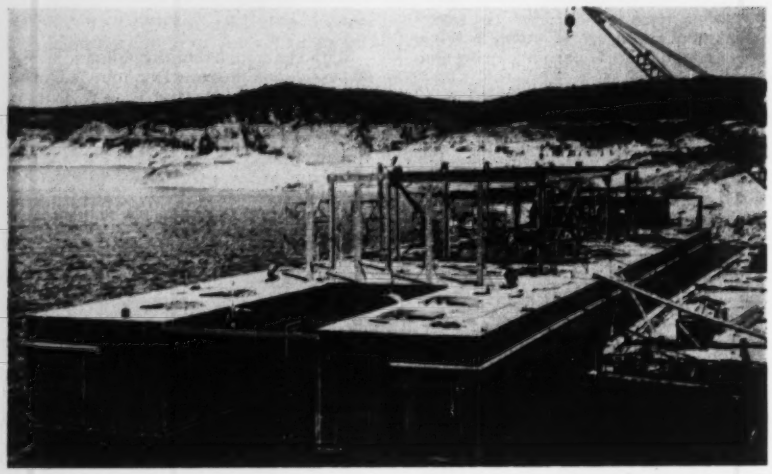
The construction crew was able to maintain an impressive production rate in driving the pipe piling—almost double the rate obtainable on such a project with other types of piling. The piling withstood 15,000 ft-lb of impact during the driving. After each section was driven, workers were able to fit inserts without any loss of time due to head trimming or straightening. This meant that the follower pipe section could be inserted in position and welded in a matter of minutes.

The four-mile, four-lane expressway will extend from the bypass at Middletown N. Y., to the Thruway. Work for this section, which is valued at $4,250,000, started June 1, 1954, and is scheduled for completion next June.

Pipe pilings used for land footings for one of the bridges involved in a New York Thruway connecting road are pictured here. Larger view shows one of the 90-ft sections being picked up by crane and guided into its leads.



Mighty Dredge Launched in Canadian Waters



The second of the two largest dredges ever built is launched at Falls Bay, Atikokan, Ontario, Canada. Christened the Joseph L. Block, the dredge is a companion unit to the Clarence B. Randall launched earlier at the same location. Both have hulls 176 ft long by 50 ft wide by 14 ft deep, and weigh about 600 tons without their machinery. Each is powered by a 10,000-hp motor driving a 36-in. pump with a capacity of 60,000 gpm of water and solids. Built by Construction Aggregates Corp., of Chicago, the dredges will be operated by that firm for the Calend Ore Co., Ltd., a subsidiary of the Inland Steel Co. In one of the greatest dredging operations ever undertaken, the two dredges will remove some 160,000,000 cu yd of silt overburden from the bay—equivalent to an excavation three miles long, one mile wide, and 400 ft deep, and approaching the dredging volume required for the Panama Canal. Each dredge will be followed by two booster stations of equal pump capacity. The silt will be removed a distance of 61,000 ft through 36- and 42-in. pipelines. Individual dredge capacity is estimated at 86,400,000 gpd.

AGC Nominates New Officers and Takes Action On Industrial Problems at Mid-Year Meeting

George W. Koss, M. ASCE, of Des Moines, Iowa, has been nominated for 1955 president of the Associated General Contractors of America, and Frank J. Rooney, of Miami, Fla., has been nominated vice-president. The nominations were made at the mid-year meeting of the AGC's Governing and Advisory Boards held in St. Louis in September. Mr. Koss, a graduate of Harvard and current vice-president of the AGC, is president of the Koss Construction Co., one of the largest concrete-paving firms in the country. Mr. Rooney, a Miami building contractor, is a native of New York State and graduate of St. Francis College, Brooklyn. They will be elected by letter ballot in December, and installed at the close of the organization's 36th annual convention in New Orleans in March.

Significant problems facing the industry, including labor policy, subcontractor relations, and the peculiar market conditions existing in construction today, were also discussed at the three-day session—the largest board conclave in AGC history. Consciousness of the increasing weight of public responsibility that must be assumed by general contractors and the association was an undertone throughout the sessions. This tenor was expressed in the opening remarks of President John MacLeod, of Paramount, Calif., who stated in part:

"Of all the basic industries, construction alone has been rising, while business in most other lines has been leveling off or declining. It is very significant that construction now represents more than one dollar out of every seven dollars spent in this country for all goods and services, and is responsible for the employment of more than 15 per cent of all full-time equivalent employees."

The meeting received favorably the results of a nation-wide survey early last month among AGC chapters and directors that indicated the record volume of construction should continue for the next six months, with stable conditions prevailing in material prices and wages and increasing competition among contractors. It was the consensus of the group that heavy construction faces a decline in volume because federal awards in this field of the industry have decreased 30 percent this year, with most awards given for continuations and not for new projects. A recommendation was adopted, requesting that "Congress make adequate appropriations so that a sufficient number of new starts on major public works projects designed to develop our national resources be made in each succeeding year."

Charleston Approves Bushy Park Water Project

Charleston, S. C., is assured a tremendous new industrial water supply by the City Council's unanimous approval of a $1,000,000 bond issue to initiate work on the Bushy Park Project. The project, which will make available a fresh water supply of 2,500 mgd, will involve construction of a dike and canal to divert the waters of the Cooper River into Back River, and safeguard them from salt-water infiltration. It will also provide some 4,400 acres of potential industrial sites between the two rivers for sale to large industries, which in turn will buy the water. The industrial sites will have the additional advantage of being adjacent to deep-water ocean transport.

Ford, Bacon & Davis, of New York, did a feasibility study on the project for the Charleston Development Board, and have now been engaged as consultants. Arthur M. Field, M. ASCE, chief engineer of the Development Board, is credited with being the first to see the possibilities of the project and with initial planning. Work will start early in 1955.

Dorr Co. and Oliver United Filters Merge

Completion of an agreement for the merger of the Dorr Co., which has its headquarters in Stamford, Conn., and Oliver United Filters, Inc., with headquarters in Oakland, Calif., is announced by the two organizations. If approved by the stockholders of both companies, the merger will become effective at the end of the year. The name of the merged company will be Dorr-Oliver Inc., with headquarters in Stamford. Officers will include the two founders, Edwin L. Oliver and John V. N. Dorr, as chairmen of the board, and J. Delano Hitch, Jr., as president.

Both companies had their beginning in the mining and metallurgical field, but now supply complementary equipment and engineering services to practically every processing industry as well as in the sanitation field.

7,000 ITEMS A KEY TO K&E LEADERSHIP

Drafting, Reproduction, Surveying,
Optical Tooling Equipment and Materials
Slide Rules Measuring Tapes

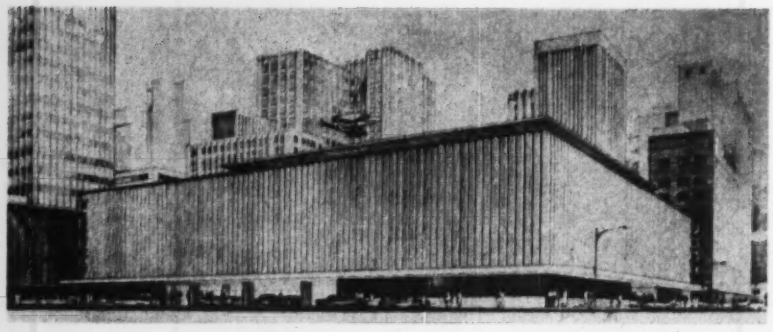
• Since 1867 engineers, scientists, designers, surveyors, draftsmen have relied on K&E as the foremost, most progressive, and most complete source of supply for the tools, equipment, and materials they work with. When you buy, think first of K&E, headquarters for 7,000 items. For example . . .

THE PARAGON® DRAFTING MACHINE

Thorough knowledge and thorough care of minutest detail were essential to the designing of the sturdy, accurate Paragon® Drafting Machine. Draftsmen prefer the Paragon, because it is time-saving and work-sparing, because it is reliable, easy to operate, and because they don't have to treat it with kid gloves. The Paragon Drafting Machine increases drafting room efficiency enormously, and effects substantial economies.

KEUFFEL & ESSER CO.
EST. 1867
New York • Hoboken, N. J.
Chicago • St. Louis • Detroit • San Francisco • Los Angeles • Montreal
Distributors in Principal Cities

Houston, Tex., to Have Large Parking Garage



Houston, Tex., will have off-street parking space for 2,500 cars when an eight-level parking garage, shown here in artist's rendering, is built. The largest car-parking facility in the South and one of the largest in the country, the project will be constructed for the Tennessee Gas & Transmission Co. on a 55,000-sq ft site in the heart of the city. Two of the eight parking levels will be underground and will include an auto-servicing area. Special features include a roof heliport for helicopter landings and take-offs and pedestrian walkways under two streets. The walkways will be air conditioned, served with escalators, and lined with window displays. The building will be of reinforced concrete, with exterior surfacing of 2-ft-wide aluminum panels alternating with and overlapping panels of a white translucent plastic baffled to allow free circulation of air while excluding the elements and direct sunlight. The Houston consulting firm of H. E. Bovay, M. ASCE, did the structural design and prepared plans based on traffic studies. Bids will be taken and a contract let in December, and construction will start in January.

Quartermaster Research Center Opened by Army

A new $11,000,000 Quartermaster Research and Development Center at Natick, Mass., which was dedicated on October 14, will consolidate all the Quartermaster Corps research laboratories previously scattered throughout the country. The new center will also be headquarters for the recently established Quartermaster Research and Development Command, headed by Brig. Gen. Charles G. Calloway. It is the first scientific institution designed to permit study of human physical reaction and evaluation of experimental military equipment under virtually all known climatic conditions. An outstanding feature is the Climate Research Building that eventually will house climatic chambers, in which may be produced simulated weather conditions ranging from 70 deg below zero to 168 deg above, and from tropical cloudbursts to Arctic snowstorms with winds up to 40 miles an hour.

Speakers at the dedication ceremonies, including Secretary of the Army Robert T. Stevens, Gen. M. B. Ridgway, and Maj. Gen. K. L. Hastings, pointed out that "our survival as a nation hinges, in a very real sense, upon the achievements of our scientists."

Nuclear Notes

VII—Nuclear Reactions

"Nuclear Notes" are prepared for the Sanitary Engineering Division by its Committee on Sanitary Engineering Aspects of Nuclear Energy. Conrad P. Straub, of the Oak Ridge National Laboratory, heads the committee, which also includes S. T. Barker, A. E. Gorman, Prof. Warren J. Kaufman, and James G. Terrill, Jr. Next month's subject will be: "Neutron Reactions and Fission."

In the two previous columns natural radioactivity was discussed—that is, nuclear activity in naturally occurring elements. The present column and the next will be devoted to a consideration of nuclear reactions produced by artificial means. The first part of the discussion will consider the methods by which nuclear reactions may be produced and the probability of their occurrence, whereas the second part will deal with neutron reactions responsible for induced activity and for fission.

The first nuclear reaction was discovered by Rutherford (in 1919) and resulted from the bombardment of nitrogen with alpha particles from RaC′ (polonium-214) producing protons and oxygen. The reaction may be expressed in the following notation

$$_7N^{14} + {}_2He^4 \rightarrow {}_8O^{17} + {}_1H^1$$

or using nuclear shorthand, in the form

$$N^{14}(\alpha, p)\, O^{17}$$

Artificial activity was discovered in 1934 by I. Curie and F. Joliet, who studied the emission of neutrons and positively charged particles from light elements under α-particle bombardment and found that some of the elements such as B, Mg and Al, continued to emit positrons after removal of the α-particle source. In the reaction between aluminum and α particles, for example, the product is P^{30} which decays by positron emission to Si^{30} with a 2.5-min half-life. This reaction is written

$$_{13}Al^{27} + {}_2He^4 \rightarrow {}_{15}P^{30} + {}_0n^1 \quad \text{or} \quad Al^{27}(\alpha, n)P^{30}$$

and

$$_{15}P^{30} \rightarrow {}_{14}Si^{30} + B^+, \quad T^* = 2.5\,\text{min}.$$

* T = half life.

It will be seen that nuclear reaction notation is analogous to chemical reaction notation, with the reactants on the left and the reaction products on the right-hand side of the equation. Furthermore, in all reactions observed to date, and there have been several thousands of them, the number of protons (total Z) and the total number of neutrons and protons (total A) are conserved, just as in chemical reactions the number of atoms of each element are conserved. In the nitrogen reaction, it will be seen that the Z and A values total 9 and 18, respectively, on both sides of the equation, and 15 and 31 in the aluminum reaction, respectively.

From these equations it is also possible to calculate the energy. For example, in the first equation, the sum of the left-hand members amounts to 18.01141 mass units (m.u.), and the right-hand members to 18.01262 m.u.; thus an amount of energy equal to 0.00121 m.u. has to be supplied to make the reaction possible. The amount of energy required may be calculated from this difference in mass by Einstein's equation $E = m c^2$, where E is the energy in any convenient units, m is the mass in associated units, and c is the velocity of light in cm/sec. Substituting, we find

$$E_{(Mev)} = \frac{-0.00121\,(3 \times 10^{10})^2\,(1.66 \times 10^{-24})}{1.6 \times 10^{-6}} = -1.13\ \text{Mev},$$

where 3×10^{10} is the velocity of light in cm/sec, 1.66×10^{-24} grams/m.u., and 1.6×10^{-6} is the factor for converting ergs to Mev. Expressing this result in kilogram calorie units, a value of 2.61×10^7 kg cal is obtained, which is about 10^8 times larger than the largest values observed for heats of chemical reactions.

Another property of nuclear reactions as with chemical reactions is their reversibility.

Glass containers for every purpose are designed and manufactured by Owens-Illinois Glass Company—over 100 billion units made in last 25 years

More than 3,000 new designs per year
—without a "bottleneck" in drafting

In the Design Development Department of the Owens-Illinois Glass Company, Toledo, Ohio, no time is lost in tedious redrafting. A simple short cut involving the use of Kodagraph Autopositive Paper and Kodalith Film *gives customers fast service . . . saves dollars every day.* Chances are you can adapt this technique to your own routines.

Big head start. Kodalith Film prints of elements which are repeated from time to time are kept on file. When a new design calls for any of these elements, the draftsman merely tapes the right films on clear acetate *and orders an Autopositive.* No redrafting!

A positive photographic intermediate is produced *directly* by exposing the "paste-up" in contact with Kodagraph Autopositive Paper, then processing the print in standard photographic solutions. No negative step . . . *easy room light operation.*

New design is added to the Autopositive, which has dense photographic black lines on a clean white translucent base. Required number of shop prints—each crisp and uniform—are produced from this master, which can also be used later on for minor revisions.

Kodagraph Autopositive Paper

"THE BIG NEW PLUS" in engineering drawing reproduction

Shows all the ways you can save with Kodagraph Autopositive Paper.

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY
Industrial Photographic Division, Rochester 4, N. Y.

93

Gentlemen: Please send me a copy of "New Short Cuts and Savings."

Name_____ Position_____

Company_____ Street_____

City_____ Zone____ State_____

Kodak

Until quite recently, the number of known nuclear reactions was relatively small, because the only sources of high-energy particles were the naturally occurring radioactive elements. With the development of particle accelerators, it became possible to increase many-fold the numbers and types of reactions that could be demonstrated. The cyclotron, for example, was operated in 1931. Other accelerators include the van de Graaf machine, the betatron (available before World War II), the synchrocyclotron, and the synchrotron (developed after World War II). One of the largest sources of particles for nuclear reactions is the nuclear reactor, or pile, as it is commonly called. The different types of reactors that are available will be discussed in the next article along with neutron reactions.

Whereas early workers were restricted to the use of alpha and beta particles and gamma rays emitted from naturally radioactive materials, present investigators are not handicapped in this manner. At present, the most frequently used projectiles for nuclear bombardment are protons (hydrogen atoms), neutrons, deuterons, α particles (helium atoms), and photons (γ rays). Since these reactions may be made to take place, under suitable conditions, with any of the known 80 stable elements, it is seen that a great many reactions can take place. Unstable nuclides also will react when bombarded under suitable conditions. Some examples of nuclear reactions are given below:

$$_3Li^7 + {}_1H^1 \rightarrow {}_2He^4 + {}_2He^4 \text{ or } Li^7(p, \alpha)He^4$$
$$_3Li^6 + {}_1H^2 \rightarrow {}_2He^4 + {}_2He^4 \text{ or } Li^6(d, \alpha)He^4$$
$$_3Li^7 + {}_2He^4 \rightarrow {}_5B^{10} + {}_0n^1 \text{ or } Li^7(\alpha, n)B^{10}$$
$$_3Li^6 + {}_0n^1 \rightarrow {}_1H^3 + {}_2He^4 \text{ or } Li^6(n, \alpha)H^3$$
$$_1H^2 + h\lambda \rightarrow {}_1H^1 + {}_0n^1 \text{ or } H^2(\gamma, n)H^1$$

The nuclear reaction that will occur is a function of the particles involved (as illustrated above), their energies, and the cross section of the target material. The cross section of a particular element defines the efficiency or probability of a nuclear reaction taking place and has the dimensions of area, generally expressed in terms of cm^2 per nucleus. Experimental values for nuclear cross sections are usually in the neighborhood of 10^{-27} to 10^{-24} cm^2/nucleus, although higher and lower values are known. A unit called the barn, equal to 10^{-24} cm^2/nucleus, has been adopted.

Summarizing, nuclear reactions may be made to take place under the action of different types of nuclear particles. The resultant product is dependent upon the energy of the accelerated particle and the cross section of the target material.

References

1. *Sourcebook on Atomic Energy* (Chapter X), by Samuel Glasstone. D. Van Nostrand, Inc., New York (1950).
2. *The "Particles" of Modern Physics*, (Chapter 11), by J. D. Stranathan. The Blakiston Company, Philadelphia (1945).
3. *Introductory Nuclear Physics*, (Chapters 9 and 10), by D. Halliday. John Wiley and Sons, Inc., New York (1950).
4. *Introduction to Radiochemistry*, (Chapter III), by Gerhart Friedlander and Joseph W. Kennedy. John Wiley and Sons, Inc., New York (1949).
5. *Nuclear Radiation Physics*, (Chapters 12 and 13), by R. E. Lapp and H. L. Andrews. Prentice-Hall, Inc., New York (1949).

N. G. Neare's * COLUMN

R. ROBINSON ROWE, M. ASCE

"I know," confessed Joe Kerr, "you didn't expect me to figure the length of the teetering wedge, but I had a nice review of slope-deflection analysis, as far as I went."

"How far did you go?" asked the Professor.

"I'll show you. I let x equal the required length from butt of the 4 × 4 to support and analyzed a unit width of the wedge as a double cantilever supported at its third point. With redwood weighing 27 lb per cu ft, the weight at a distance kx from the thin edge was $k/48$ in.-lb. The sketches show curves for load, shear, moment, curvature, slope, and deflection, respectively. Also shown are equations of all the curves, differing each side of the support.

"Equations for the left side are pretty groovy, but those on the right are gaining momentum with each integration. I hated to think of one more integration for the centroid, so from there I went deer-hunting."

"Good seasonal escapism," conceded the Professor. "I'll bet, tho, that some of the members don't know what you were talking about, so I'll explain for Guest Professor Sauer Doe, who couldn't be here tonite, that Joe started to work Doe's problem of the teetering wedge. The wedge is half of a long redwood 4 × 4 split on the long diagonal and balanced on a wire. As explained last September, to teeter without tottering, the wedge must bend until its centroid is at or below the support. The longer the wedge, the more it bends, so a minimum length can be computed from its section and elasticity. Not hard, was it Cal?"

"Not as hard as it looked at first," agreed Cal Klater. "The centroid is computed from the integral form:

$$\bar{y} = \frac{\int y h \, dk}{\int h \, dk}$$

where h is the variable depth of the beam in terms of the length parameter k and y is the deflection from Joe's equations. Since $h = 4k/3$, the denominator is 6 and the form becomes:

$$\bar{y} = \frac{1}{6}\left(\frac{-3x^4}{819200000}\right)\left[\int_0^2 2(2-k)^2 \cdot \frac{4k}{3}\,dk + \int_2^3 \left(2k^2 - 35k + 8 + \frac{108}{k} + \log\frac{k}{2}\right)\cdot\frac{4k}{3}\,dk\right]$$

$$= \frac{-3x^4}{819200000}(108 \log 1.5 - 43)$$

"Looking at Joe's deflection curve, the dotted lines represent the upper and lower faces of the wedge relative to the solid axis ABC, so $\bar{y} = BD = 4/3$. Substituting and solving for x:

$$x = \frac{160}{3}\sqrt[4]{\frac{45}{108 \log 1.5 - 43}} = 146.51 \text{ in.} = 12.21 \text{ ft.}"$$

"That's right, and the reward for mathematical slavery is to find the coincidence that the deflection of C is also 4/3, so that C and D are on the same level.

"Now, if you recall that I sent word in September that I was travelling with a bunch of "ferrets" inspecting culverts and that last month I promised a culvert problem, you will be interested in an observation of Ib, an Iowa ferret. Finding most culverts dry and learning of trillion-dollar projects to utilize all of California's water, he predicted that our stupendous investment in culverts would be a total loss. I told him we were already planning to transform them into subterranean silos for storage of our surplus potatoes, especially the big spherical ones grown in San Diablo County. In 27-in. pipes we would probably store watermelons, because the void ratio for potatos would be 50 percent greater than for 18-in. pipe. How big is a San Diablo County potato?"

[Cal Klaters were Richard Jenney, Ed C. Holt, Jr, Rudolph W. Meyer, and Thatchrite (Guy C. Thatcher).]

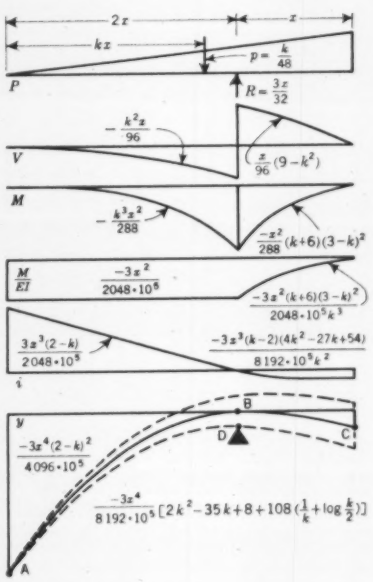
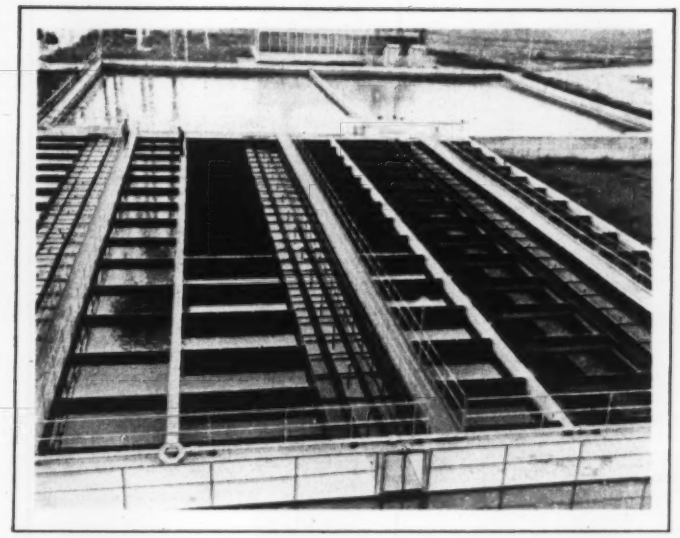
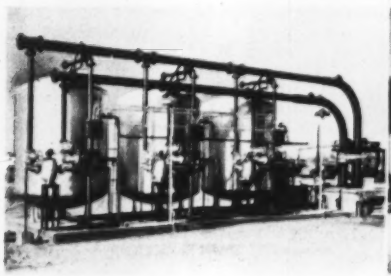


FIG. 1. Axis ABC bends until the centroid is at the fulcrum D, but Joe Kerr couldn't do it.

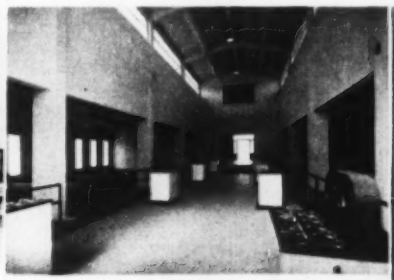


PRECIPITATOR. Coagulation, precipitation and settling in one operation! Minimum space . . . stable effluent. Reduces turbidity, color, taste, odor, hardness, iron, manganese, alkalinity, silica.

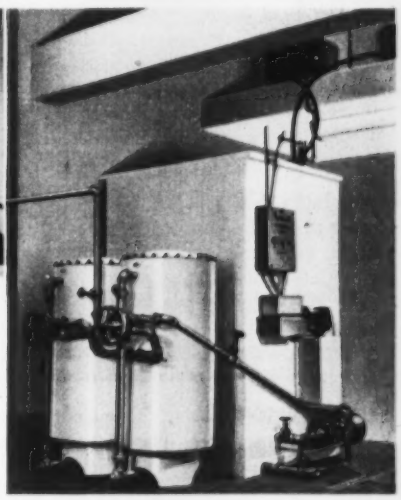
WHICH Permutit Process will solve YOUR water problem?



ZEOLITE (Ion Exchange) SOFTENERS remove total hardness. Reduce iron and manganese. Permutit multiport-valve control is fully automatic! Saves operator's time . . . increases efficiency.



FILTERS. Rapid type gravity filters in concrete or steel. Vertical or horizontal pressure filters. Manual or fully automatic multiport-type control for single units or batteries.



PACKAGE WATER CONDITIONING PLANT. Reduces organic matter, turbidity, taste, odor, hardness, iron, manganese, alkalinity. Compact . . . ideal for small municipalities. Flow rates up to 50 gpm.

Permutit can help you decide . . .

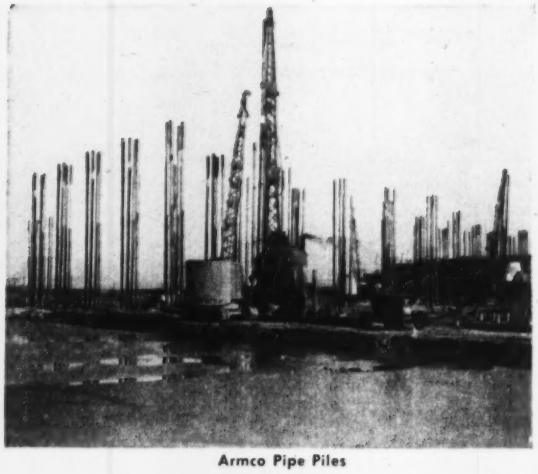
PERMUTIT will make a free analysis of your city's water supply and make recommendations to you or your consultants. Remember—only Permutit manufactures both ion exchangers and all types of water conditioning equipment.

Write today for information on municipal water conditioning equipment. The Permutit Company, Dept. CV-11, 330 West 42nd Street, New York 36, N. Y.

Water Conditioning Headquarters for Over 40 Years

PERMUTIT®

Here's Foundation Pipe for Every Need



Armco Pipe Piles

Most foundation pipe jobs are different. But with the wide selection of Armco Pipe Piles, Pile Shells and Caissons—it's easy to find the foundation pipe that meets your requirements exactly.

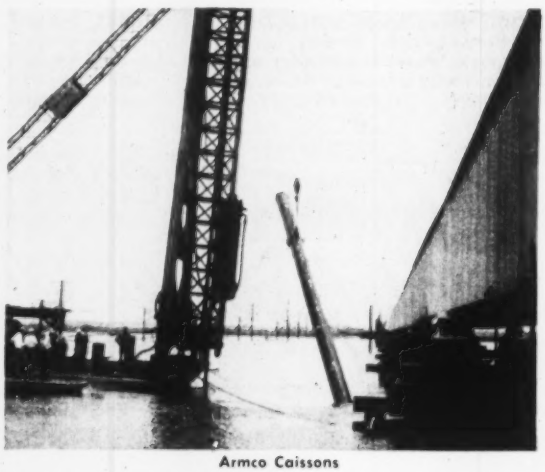
ARMCO PIPE PILES are of spiral-welded fabrication. They offer high collapse resistance; unusually great beam strength for straighter driving; constant cross-section for maximum end-bearing in good strata; and uniform diameter that permits salvaging cut-offs. Pipe piles are available with mill-attached plate ends, cone points and cutting shoes.

SIZES: Diameters range from 8⅝" to 22", O.D. Wall thicknesses from .141- to .500-inch. Standard lengths up to 60 feet. Longer lengths available.

Armco Pile Shells

ARMCO HEL-COR PILE SHELLS have helical corrugations and a continuous lock-seam. They are easily handled, light in weight, extremely straight, uniform in diameter and water-tight. Cut-offs can be salvaged by field welding. Armco Pile Shells are widely used for Cobi mandrel-driven or drop-in shells and for the top portion of composite piles.

SIZES: Diameters range from 8⅝" to 22⅛", O.D. Wall thicknesses from 18 to 14 gage. Lengths up to 60 feet.



Armco Caissons

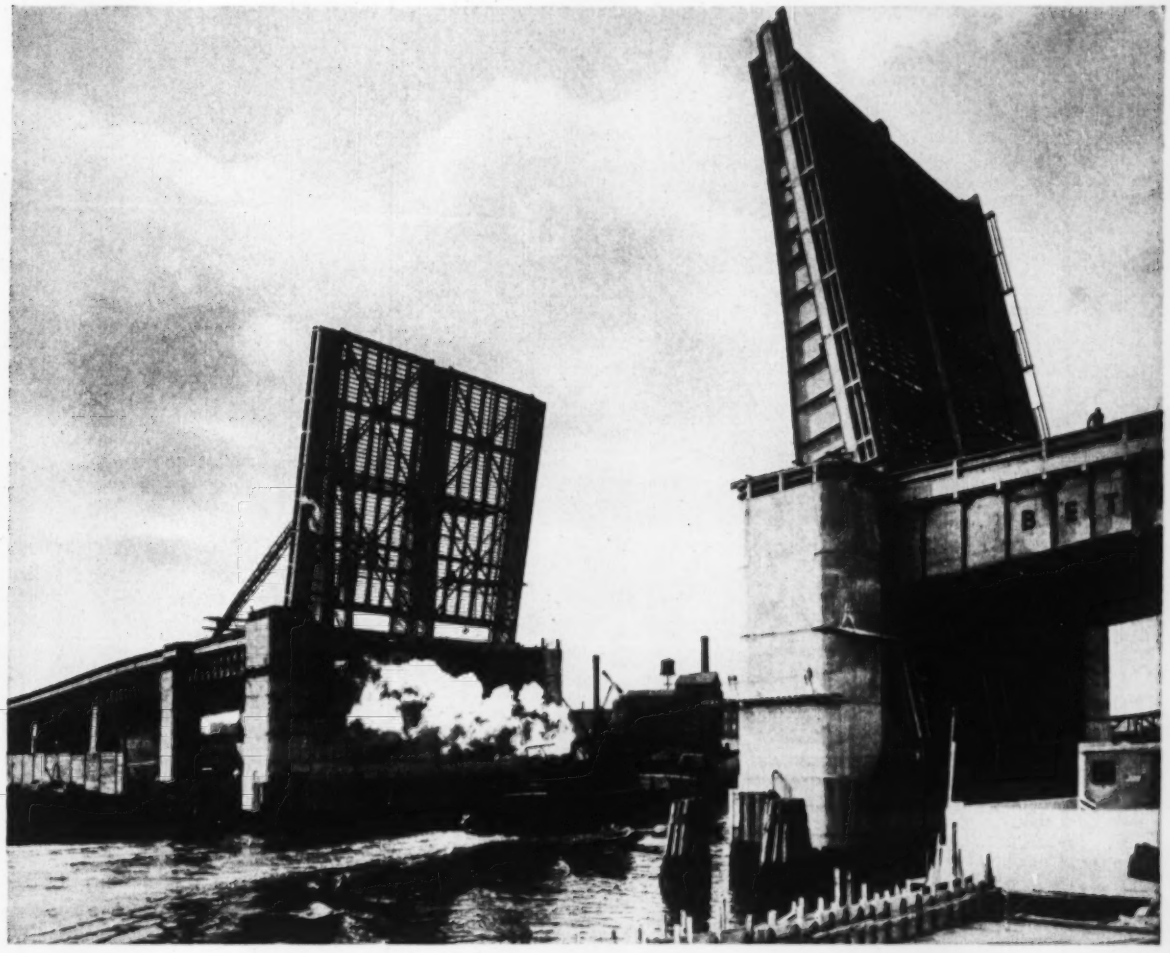
ARMCO CAISSONS are of the same spiral-welded manufacture as Armco Pipe Piles. The principal difference is in larger diameters and heavier wall thicknesses. They meet the most severe requirements in driving and loading, and have been proved under the most difficult conditions.

SIZES: Diameters range from 24" to 36". Wall thicknesses are from .375- to .500-inch. Standard lengths range up to 70 feet.

Write us for more data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 2504 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

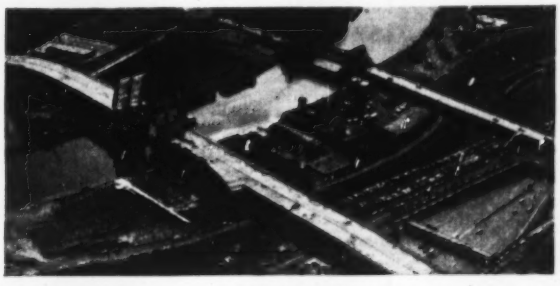
ARMCO FOUNDATION PIPE

ARMCO



SIX-LANE BASCULE BRIDGE IS NEW QUEENS-BROOKLYN LINK

Motorists traveling on Long Island will soon be enjoying $25 million worth of better driving. About $16 million represents parkway construction in Queens and Nassau Counties. The remainder is the cost of the Newtown Creek lift bridge, including its broad, elevated approaches.



The northerly approach to the Newtown Creek lift bridge spans the entrance to the Queens-Midtown Tunnel as well as the Long Island Rail Road yards. The old Vernon Blvd. bridge appears at upper right.

The big new span, shown here with steel erection nearly completed, carries New Vernon Avenue across Newtown Creek, the Brooklyn-Queens boundary at this point. Unlike the ancient Vernon Boulevard roller-lift bridge it replaces, the new span is high enough to allow most water-borne traffic to pass beneath the closed bascule leaves, eliminating many traffic-tangling openings.

The Newtown Creek lift bridge is of twin double-leaf bascule design, with simple trunnions, and with plate-girder approaches. General contractor was Horn Construction Co. Bridge design and supervision of work by Department of Public Works, City of New York, Frederick H. Zurmuhlen, Commissioner. Over 5500 tons of structural steel were fabricated and erected by Bethlehem Steel Co.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

This amazing view of the heaviest construction area on the Ohio Turnpike emphasizes the wide range of Flex-Plane mechanical bridge finishing from the 2600′ Cuyahoga River crossing (top) to the small 100′ exit ramps (bottom).

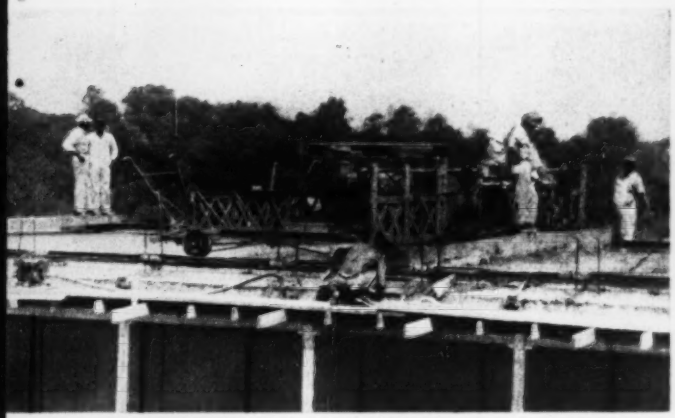
1. **Largest Bridge on Ohio Turnpike** spans Cuyahoga River south of Cleveland. It is 2682′ 3″ bearing to bearing of abutments. Slab was mechanically finished by Flex-Plane Finishing Machines.
2. **Largest Fill on Ohio Turnpike.** 106 feet deep it required 1,600,000 yards of fill dirt.
3. **Railroad Bridge** carrying the New York Central across the Turnpike.
4. **Deepest Cut on Ohio Turnpike.** The cut was made through solid sandstone 85′ in depth. More than a million and a half yards of stone were removed.
5. **Arch Span Bridge** (282′) carrying old State Route 8 across the deep cut.
6. **Small Bridge** of the many that were mechanically finished is this 181′ overpass. Flex-Plane finishing Machine can be seen at work on the ramp.
7. **Relocated Route 8 Bridge.** Double span will carry divided highway over Turnpike. West bridge will also carry deceleration lane for Turnpike entrance.
8. **Turnpike Overpass** (206′) is typical of the smaller bridges that are being mechanically finished by Flex-Plane Bridge Finishing Equipment.

The Machine that could'nt be built • Was!

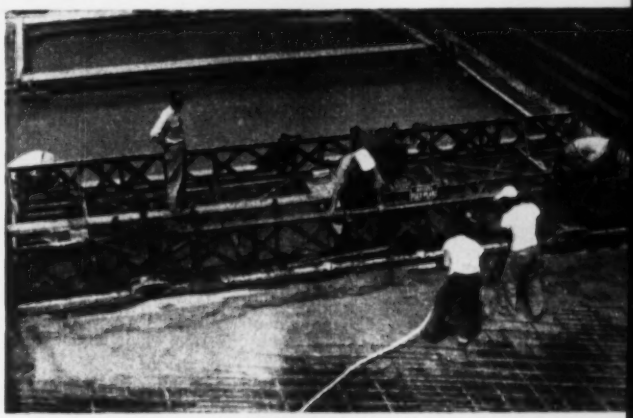
MECHANICAL BRIDGE SLAB FINISHING ON OHIO TURNPIKE PAYS DIVIDENDS

One construction firm, awarded a contract for building a piece of the Ohio Turnpike, heatedly questioned the ability of machine manufacturers to build a machine that was practical for finishing bridge slab according to the terms of the contract.

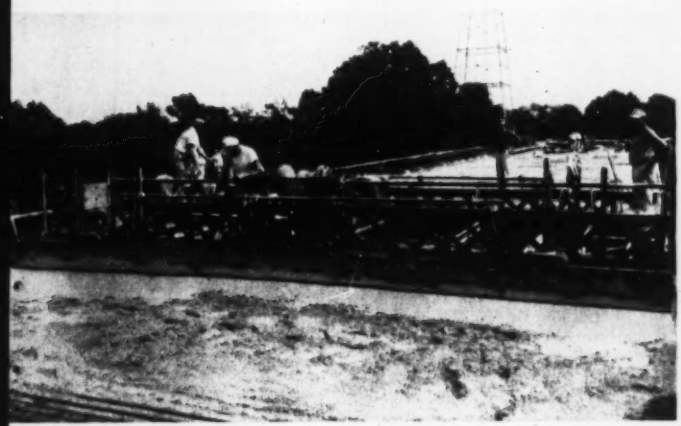
Some machine manufacturers themselves were doubtful. However, the Flexible Road Joint Machine Co., a recognized leader in the development of machinery for concrete finishing (Triborough Bridge — Pennsylvania Turnpike — etc.), set its engineers to work adapting its already successful bridge finishing machine to Turnpike specifications. The pictures below attest to the success. Not only are all the major and most of the minor bridges on the Turnpike being machine finished, but many of the secondary road over passes, where a concrete base will be topped with asphalt, are being constructed in this manner. Initial reports are tremendous. Greater uniformity, exceptional speed, beautiful riding quality, and, best of all, much less expensive.



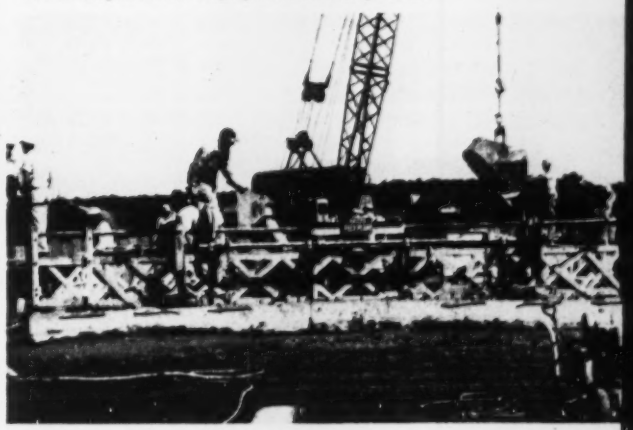
CUYAHOGA RIVER BRIDGES—All major stream crossings on the Ohio Turnpike are of dual construction. Actually two bridges—one for each direction of traffic. The Cuyahoga crossing is the longest—2682 feet. They were completely machine finished with two Flex-Plane Portable Bridge and Elevated Highway Finishing Machines. Note pneumatic rubber tired wheels in frame of machine. They are hydraulically dropped and machine becomes a trailer—easily and quickly towed anywhere along the job.



SANDUSKY RIVER BRIDGES—Crossing the Sandusky River near Fremont, Ohio, this pair of bridges is 915 feet in length. Flex-Plane Bridge and Elevated Highway Finishing Machine was used on these bridges. Actually only one operator is required to run finisher.
Note how concrete rolls in front of screed. It is not scraped or pushed. Machine leaves an extra smooth slab behind that requires a minimum of hand labor. Men in the foreground are tamping concrete through mesh.



MAUMEE RIVER BRIDGES—Note second bridge in left background. Flex-Plane Standard machine used here easily keeps pace while making a double run over slab surface. Although Turnpike bridges are standard width (30 feet) Flex-Plane Machine is telescopic and can be made to span extra-wide or extra-narrow slabs.



SECONDARY BRIDGES—Many construction firms, having experienced the ease and economy of machine finishing of bridges and elevated roadways, found they could effect savings even on the smaller ramp bridges at Turnpike entries and secondary roads. Above Flex-Plane machine is finishing overpass that is but 206 feet in length. Same machine effected savings on a 181 foot ramp in same area.

Flex-Plane Finishing Machines have played roles in the finishing of roadways and bridges on the large concrete highway projects of the past decade. Flex-Plane engineers are experts in designing equipment for modern highway finishing. Why not bring yourself up-to-date by getting your copies of Bulletins N-14 (Bridge Finishing) and P-111 (Highway Finishing).

THE FLEXIBLE ROAD JOINT MACHINE CO.
3300 THOMAS ROAD • WARREN, OHIO

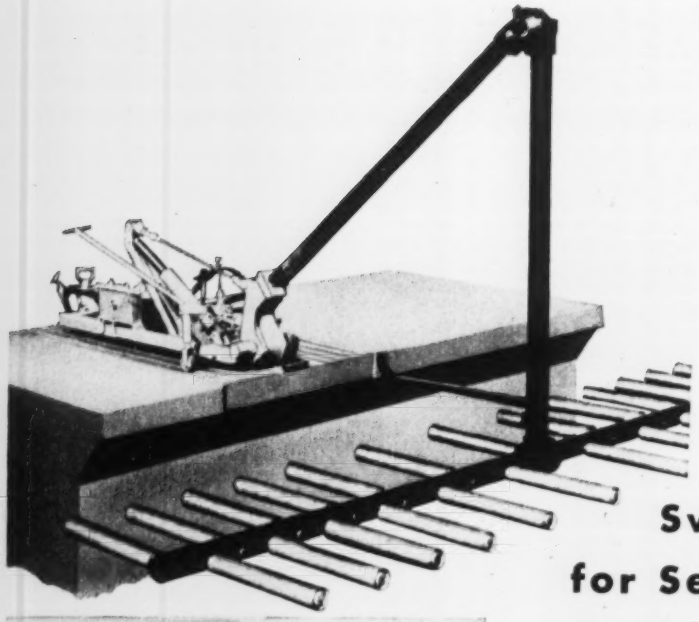
Please send Bulletin N-14 (Bridge Finishing) and P-111 (Highway Finishing)

Name.....

Company.....

Address.....

City..... State.....

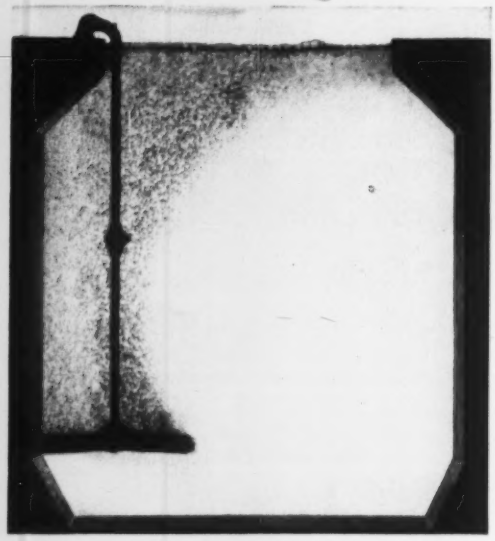


more efficient
in operation,
easier to
maintain...

Swing Diffusers for Sewage and Waste

AERATION

Chicago Swing Diffusers offer all sizes of treatment plants — both industrial and municipal — the advantages of air diffusing apparatus that is always in operation at maximum efficiency.



LIFTS UP FOR DIFFUSER MAINTENANCE

Individual Swing Diffusers can be lifted out of tank without interrupting operation, eliminating stand-by aeration tanks. Precision Diffuser Tubes are quickly and simply cleaned to new condition to achieve maximum diffusion with low head loss.

Complete Operating Histories and Descriptive Bulletin Available on Request

BOOST AERATION CAPACITY AT OLDER PLANTS, BRING HIGHEST EFFICIENCY TO NEW

Wide Band Diffusion provided by Chicago Swing Diffusers in many cases doubles the aeration capacity of previously used plate diffusion systems. For example, the Columbus, Ohio Sewage Treatment Plant was able to treat only 37 M.G.D. with their old diffuser plate system. After changing to Swing Diffusers, aeration capacity was doubled *without increasing the amount of air used or the volume of the aeration tanks.* In both old and new plants, Swing Diffusers assure maximum oxygenation.

FLEXIBLE AIR DISTRIBUTION

Individual Diffusers can be simply adjusted to balance air supply with oxygen demand for effective process control.

Swing Diffusers now used in more than 300 plants

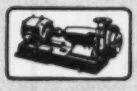
CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

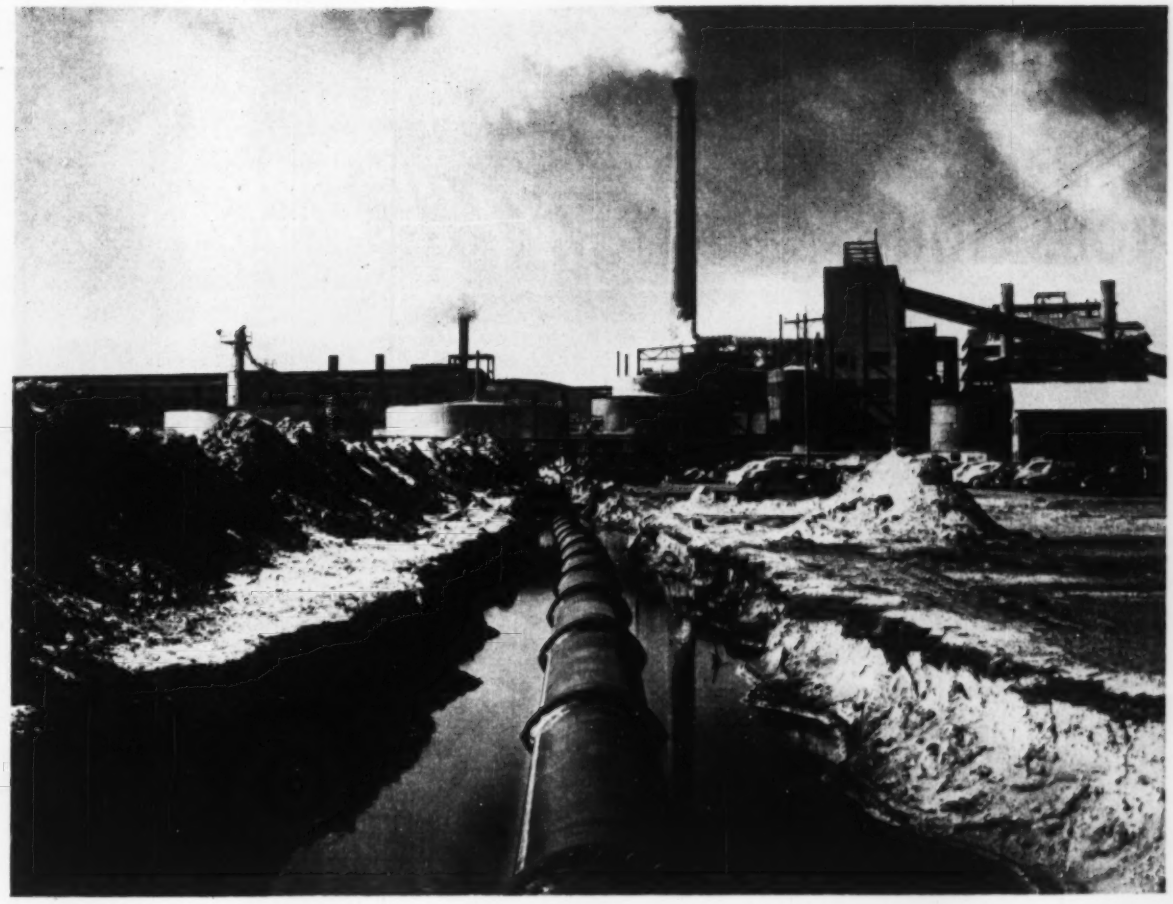
SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.



Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



AMERICAN Pipe for Permanence!

Being cast iron, AMERICAN pipe enjoys an enviable reputation. Cast iron pipe has had over 300 years of service abroad and more than 100 years of service in the United States. Manufactured in diameters 2″ through 48″, AMERICAN cast iron pipe gives complete job satisfaction. It is conveying chemicals, water, sewage, gas, crude oil, gasoline, salt brine, ashes—and in fact, just about everything that a pipe line can conceivably convey. Operating pressures range from a few psi up to pressures in excess of 100 psi gas and 500 psi liquid. Pipe and fittings can be alloyed for special corrosion resistant service or furnished with high hardness for erosion resisting services.

AMERICAN pipe is made to required wall thicknesses for specific operating conditions. You get the exact pipe your conditions require. It is equipped with any of a wide variety of joints including Double-X Mechanical Joint, Screw-Gland, Plain Ends, Threaded and Coupled Ends, Molox Ball Joint River Crossing Pipe, Roll-On Joint, Flanged, or Bell and Spigot.

Manufactured by the Mono-Cast centrifugal process, AMERICAN pipe has the lasting strength that enables it to survive continued corrosive attack, year after year, and to keep on giving the same dependable, economical service as the day it was installed. You can lay it and forget it.

Refer your next piping job to AMERICAN CAST IRON PIPE. Let us assist you by taking off lists of material and submitting prices on pipe and fittings for your next job.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

MAIL COUPON FOR LITERATURE

American Cast Iron Pipe Company,
Birmingham 2, Alabama

Gentlemen: Please send me a free copy of your literature covering the following service:

.....

Name .....

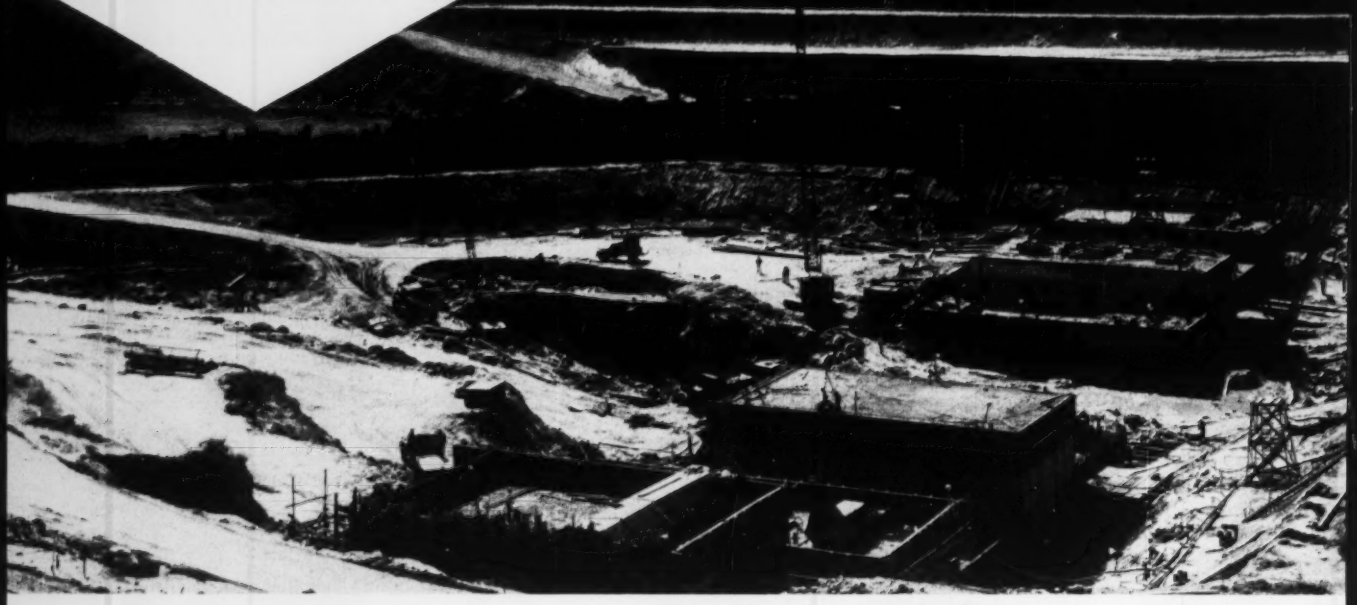
Company .....

Street .....

City ..... State .....

ON THE BANKS OF THE HOUSATONIC

...Shepaug Power Plant Progresses "IN THE DRY"



MORETRENCH WELLPOINT EQUIPMENT controls 29' of water in sand and gravel while United Engineers and Constructors, Inc., Philadelphia, excavate with speed and economy for the foundation of Connecticut's new water power plant near Sandy Hook.

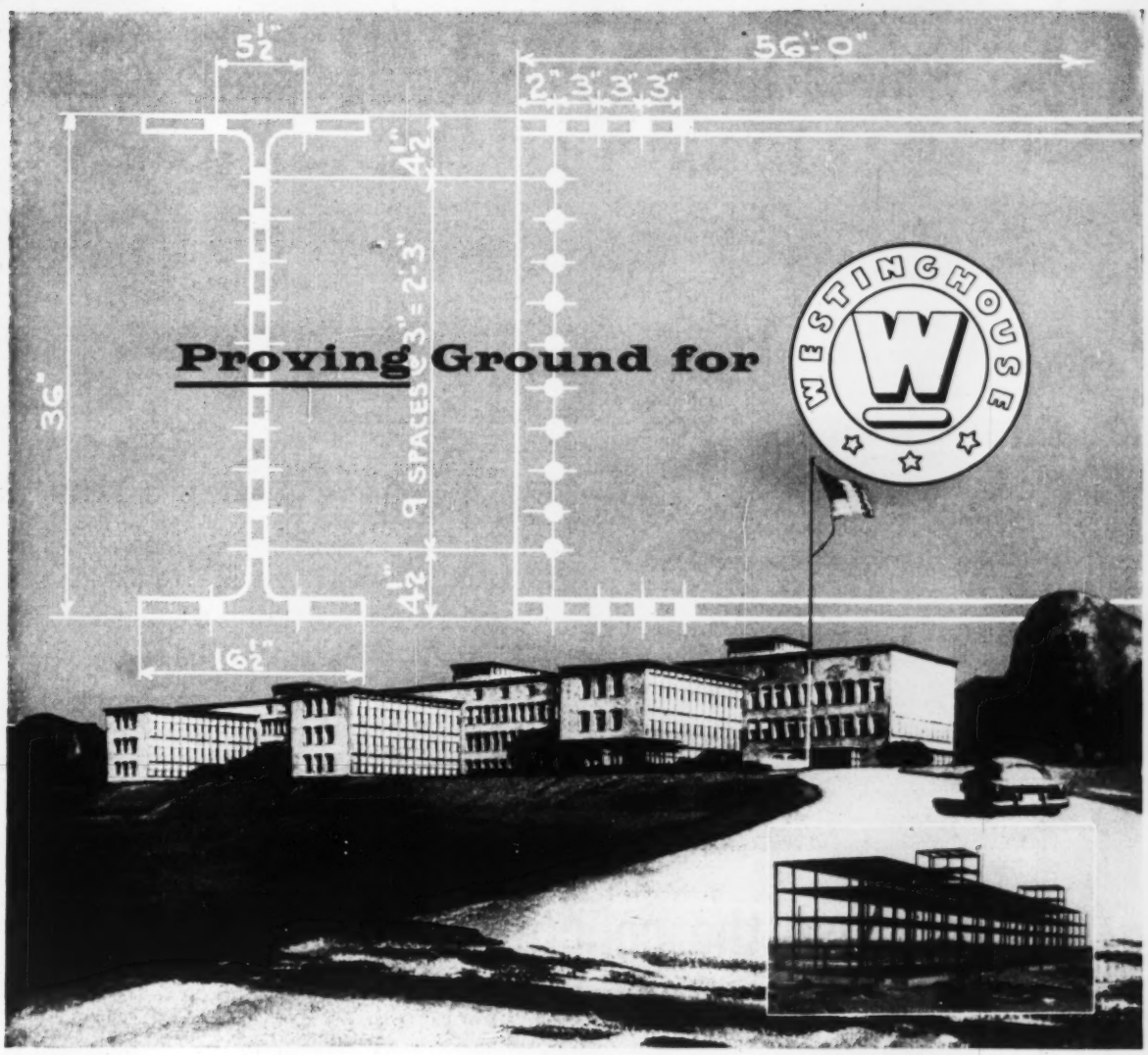
Again and again, experienced contractors select Moretrench for pumping efficiency. For thirty years we've been solving pumping problems. Let us help with yours. Whether it's large or small, we're interested. Call our nearest office. Catalog on request.

MORETRENCH CORPORATION

90 West St. New York 6 | 4900 S. Austin Ave. Chicago 38, Illinois | 7701 Interbay Blvd. Tampa 9, Florida | 315 W. 25th St. Houston 8, Texas | Rockaway New Jersey

Western Representative: Andrews Machinery of Washington, Inc., Seattle 4, Washington

Canadian Representative: Geo. W. CROTHERS Limited, Toronto, Ontario



Artist's Rendering of Westinghouse Research Laboratory at Churchill Borough, Pa.

Fabricating Steel is our Business

The stage for tomorrow's electronic magic is set today in research laboratories like this Westinghouse facility in Churchill Borough, Pa., near Pittsburgh.

Ingalls, the nation's leading independent steel fabricator, supplied the steel for the Westinghouse Laboratory as it has for so many other commercial and industrial buildings in almost every section of the country. Our 40-odd years of experience is your assurance that Ingalls can meet any fabricated steel requirement, regardless of size or location.

Plants at Verona (Pittsburgh District), Pa., Birmingham, North Birmingham, Pascagoula, Miss., and Decatur, Ala., assure you of a service that's prompt, efficient and economical.

FABRICATED STEEL
for

Power Plants • Industrial Buildings
Hangars • Bridges • Office Buildings
Churches • Stores • Apartments
Theaters • Hotels • Hospitals
Schools • Grandstands • Tanks
Pressure Vessels • Bins • Stacks

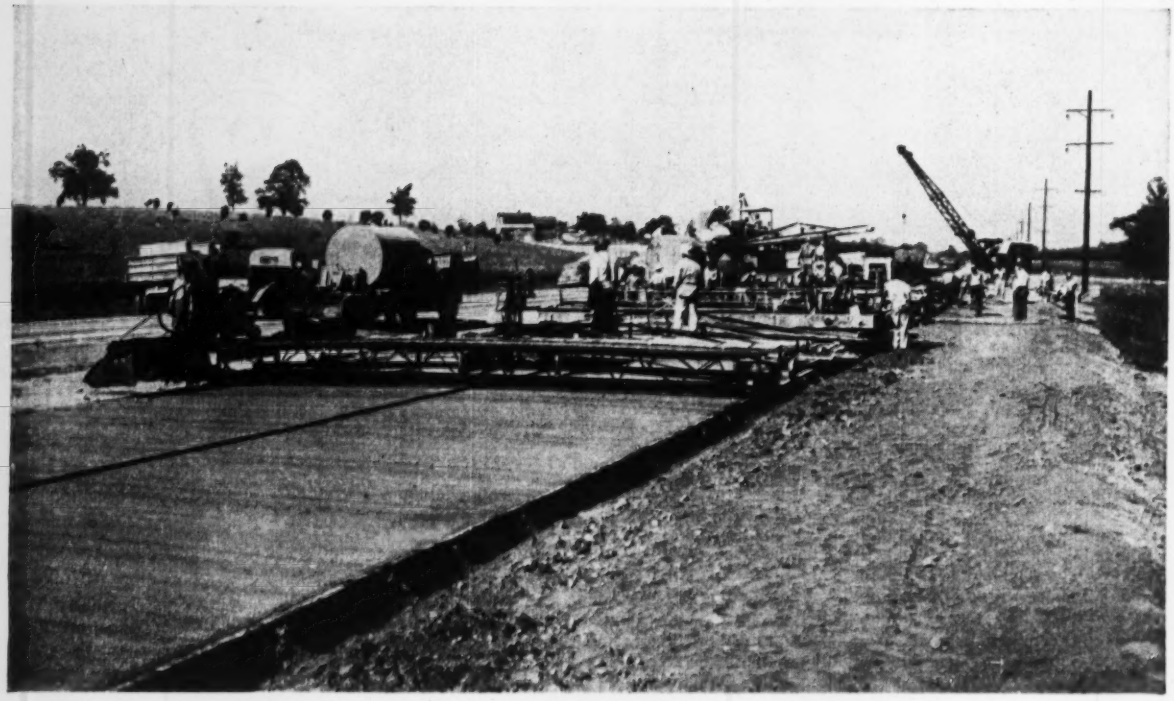
FOR COMPLETE INFORMATION WRITE:

The INGALLS Iron Works Company

BIRMINGHAM, ALABAMA

SALES OFFICES: *New York, Chicago, Pittsburgh, Houston, New Orleans, Atlanta*
PLANTS: *Birmingham, Ala., Verona, Pa., North Birmingham, Ala., Pascagoula, Miss., Decatur, Ala.*

Q. Why is there less bleeding here?



A. Because the concrete's made with Duraplastic*!

A look at this picture shows one reason why so many paving contractors use Atlas Duraplastic air-entraining portland cement. Finishers can work close behind the paver because Duraplastic minimizes bleeding.

Another advantage—and an important one in the long run—is that Duraplastic cement acts to protect finished concrete from the destructive effects of freezing-thawing weather, and de-icing salts.

Contractors find that Duraplastic cement requires less mixing water for a given slump...makes a more plastic, less segregated, mix that dumps, spreads and finishes easily.

YET DURAPLASTIC COSTS NO MORE

It sells at the same price as regular cement. Complies with ASTM and Federal Specifications. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

OFFICES: *Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.*

*"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.

ATLAS® **DURAPLASTIC**

AIR-ENTRAINING PORTLAND CEMENT

A UNIVERSAL ATLAS PRODUCT

CE-10-154-

Makes Better Concrete at No Extra Cost

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

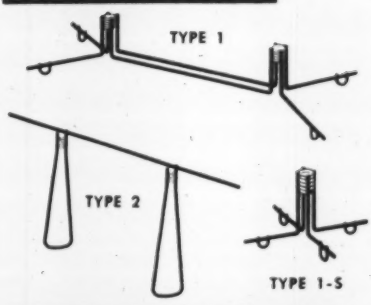
Only SUPERIOR Offers

Complete PLUS

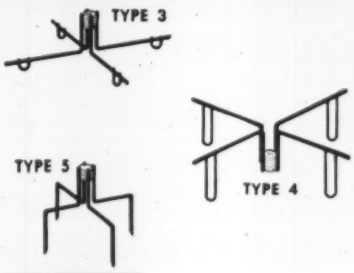
TILT-UP ACCESSORIES

Complete Engineering!

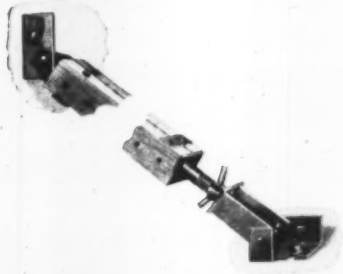
PICK-UP INSERTS



ANCHORS for BRACES

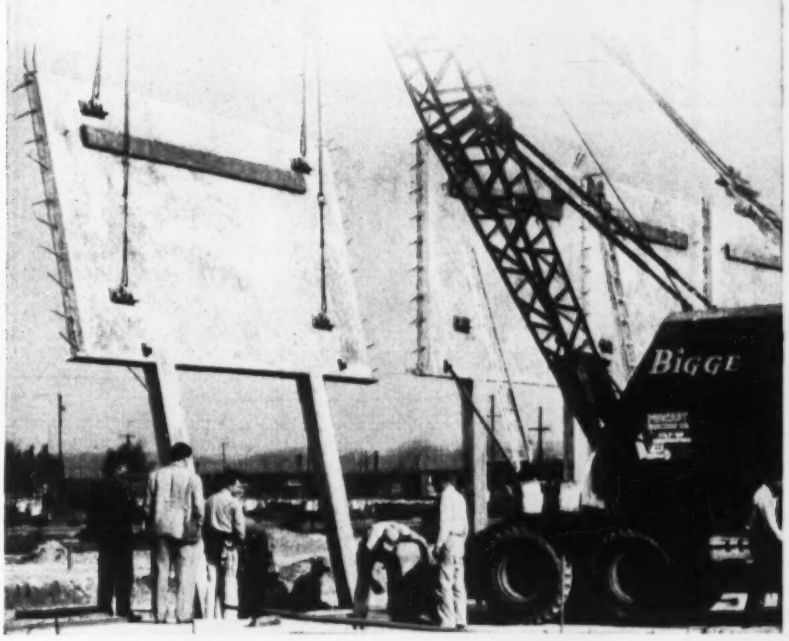


BRACES



COMPLETE ENGINEERING SERVICE

Our recommendations will be given without charge or obligation on receipt of a set of plans.



***42,000 LB. PANEL** being raised into position at United Grocers Warehouse, Fresno, Calif. Concrete panels are 8-inches thick with 12-ft. legs. SUPERIOR Pick-Up Inserts, Brace Anchors, and Braces were used. The exclusive pivoting action of the adjustable Braces permitted quick positioning and alignment of the panels. Contractor: Precast Erection Company, Niles, California.*

Tilt—Lift—Position!—The proper type of Pick-Up Inserts and Brace Anchors and their location in the slab or precast structural member is of prime importance in order to withstand the stresses occurring when *tilting*, *lifting*, and *positioning*.

As pioneers in this field, SUPERIOR has developed various types of accessories and correct procedures and techniques resulting from the experience of thousands of job applications.

The many types of SUPERIOR Inserts, Anchors, and Braces for every job condition together with complete engineering service provide a combination which offers safe and efficient handling of any precast panel or structural member.

For details request a copy of Bulletin TU-2.

SUPERIOR CONCRETE ACCESSORIES, INC.

4110 Wrightwood Avenue, Chicago 39, Illinois

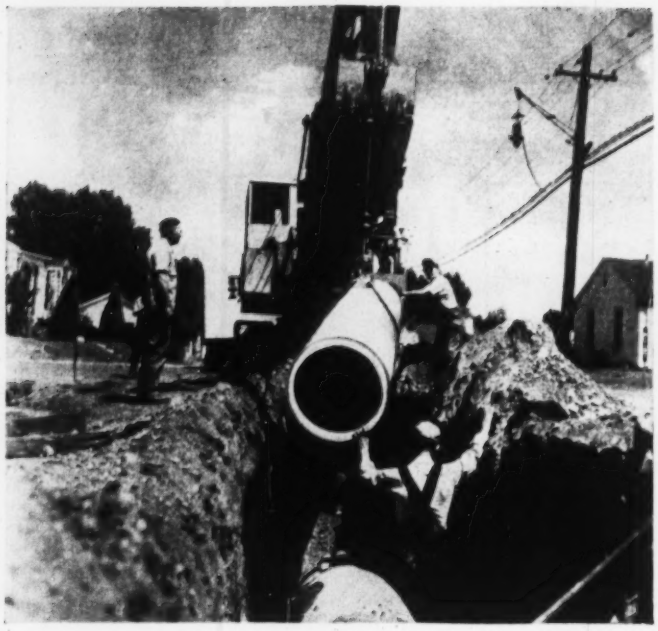
New York Office
1775 Broadway, New York 19, N. Y.

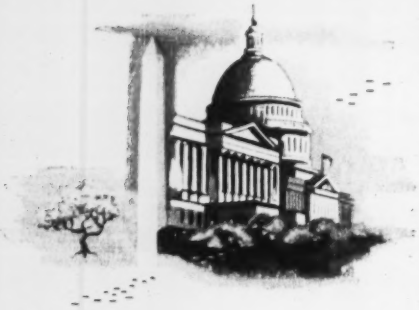
Pacific Coast Plant
2100 Williams St., San Leandro, Calif.

WASHINGTON, D. C.

PREFERS

Concrete Pressure Pipe





The District of Columbia, home of the Nation's capitol, recognizes the advantages of concrete pressure pipe. From 1925 to the present, over 175,000 feet of concrete pressure pipe have been installed in this congested 69 square mile area. Pipe diameters range from 20″ to 78″, with heads from 70 up to 450 feet. A substantial part of this footage is in use in the Washington, D. C. distribution system.

Washington engineers consider economy and length of service of primary importance when specifying water pipe . . . also, high carrying capacity, and ease of installation. Because concrete pressure pipe meets these and other exacting requirements, it has been selected time and again for new supply mains and extensions to the distribution lines.

If your community is planning additional water lines, or replacements for old lines, check into the advantages of concrete pressure pipe. It is available in sizes from 12″ to over 12′ in diameter, for high or low heads, and can be installed to fit your individual requirements.

Member companies are equipped to manufacture and furnish concrete pressure pipe in accordance with established national specifications and standards.

Concrete PRESSURE Pipe

WATER FOR GENERATIONS TO COME

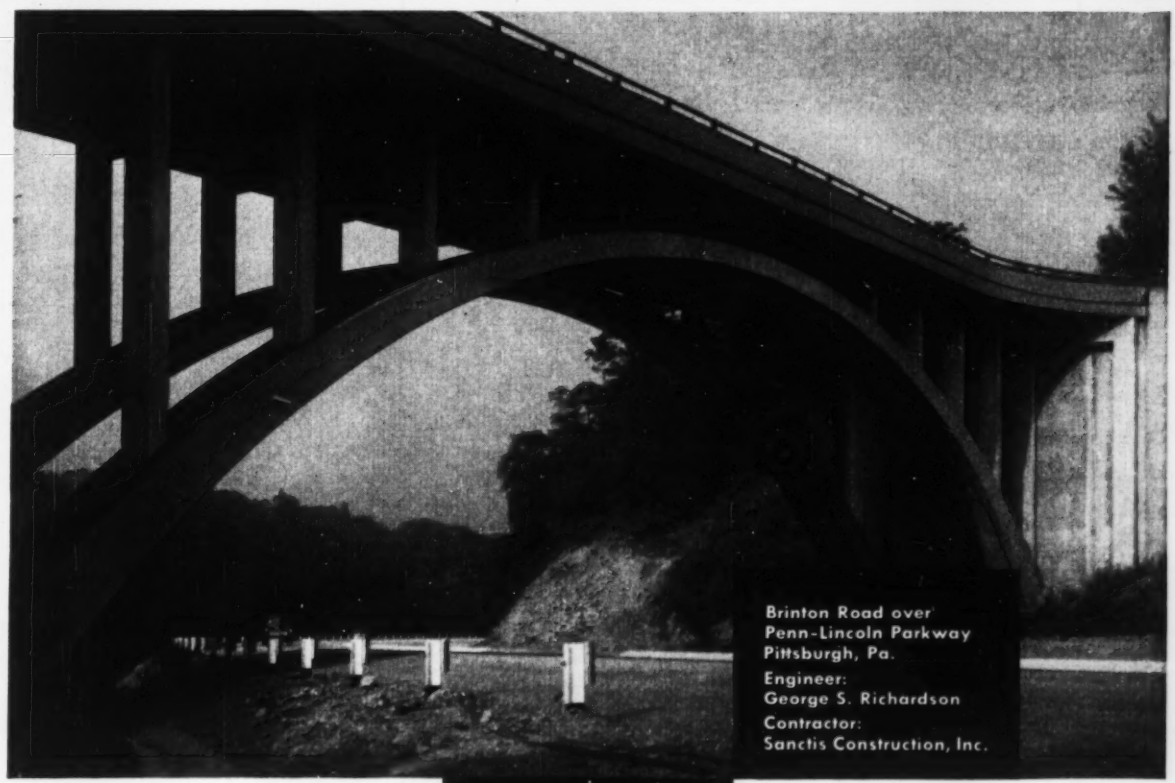
AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
228 North LaSalle Street
Chicago 1, Illinois

Bridge appropriation dollars go further when you design for reinforced concrete. And, this flexible medium permits imaginative and beautiful designs which cannot be achieved with any other type of construction.

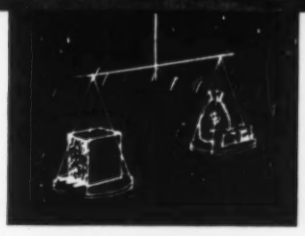
Structures built of reinforced concrete are durable, too . . . resistant to wind, shock, vibration, and quakes. Furthermore, the necessary construction materials and labor are readily available from local sources.

But find out for yourself. On your next bridge or overpass, design for *beauty plus economy* . . . design for reinforced concrete.

for BEAUTY plus ECONOMY build with REINFORCED CONCRETE



Brinton Road over
Penn-Lincoln Parkway
Pittsburgh, Pa.
Engineer:
George S. Richardson
Contractor:
Sanctis Construction, Inc.



Compare...
YOU'LL SAVE WITH REINFORCED CONCRETE

CRSI

38 South Dearborn Street • Chicago 3, Illinois

CONCRETE REINFORCING STEEL INSTITUTE

This 600 ft. bridge

refloored in 5 days with

USS I-BEAM-LOK

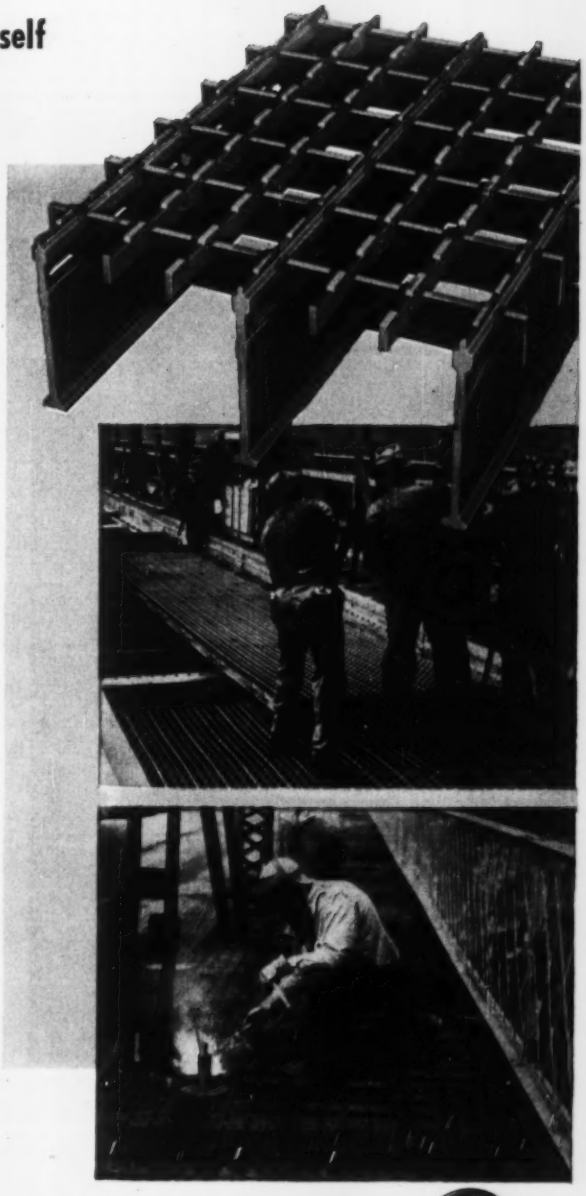
Lightweight open steel flooring will save enough in replacement costs to pay for itself in about 15 years!

WHEN fire destroyed the wood flooring on this thirty year old bridge located near Flat Top, in Jefferson County, Alabama, the engineering department of the county was faced with a real problem. And, time was *all* important, for the bridge was on a school bus route. *A quick replacement of the burned out floor was a must.* Something more permanent than the old floor was desirable. Yet, cost had to be a factor in any decision.

After considering many types of bridge flooring, USS I-Beam-Lok was chosen for the 600′ x 18′ roadway. *10,800 sq. ft. of this modern open steel flooring was installed and the bridge re-opened to traffic in just 5 days!*

Furthermore, on the basis that 5″ I-Beam-Lok weighs 18.8 psf. as against 30 psf. for the old wood flooring, the use of the more permanent lightweight steel flooring resulted in a savings of 120,960 lbs. deadweight.

And, while the cost of the new steel floor was almost 3½ times that of wood, I-Beam-Lok will easily save enough in replacement and maintenance costs to pay for itself in about 15 years . . . because the wood floor would have to be replaced every 4 or 5 years.



Takes heavier loads . . . provides smoother, safer riding—

USS I-BEAM-LOK OPEN STEEL FLOORING can be erected easily and speedily with a minimum interruption of traffic to produce a smooth-riding, skid-resisting, self-cleaning, fireproof, and long-wearing surface. Available in units measuring 6′2″ in width and up to 49′ in length, this lightweight, all-steel flooring can be applied directly to stringers on spans up to 4′ centers to permit H-20 loadings. It does not require secondary supports.

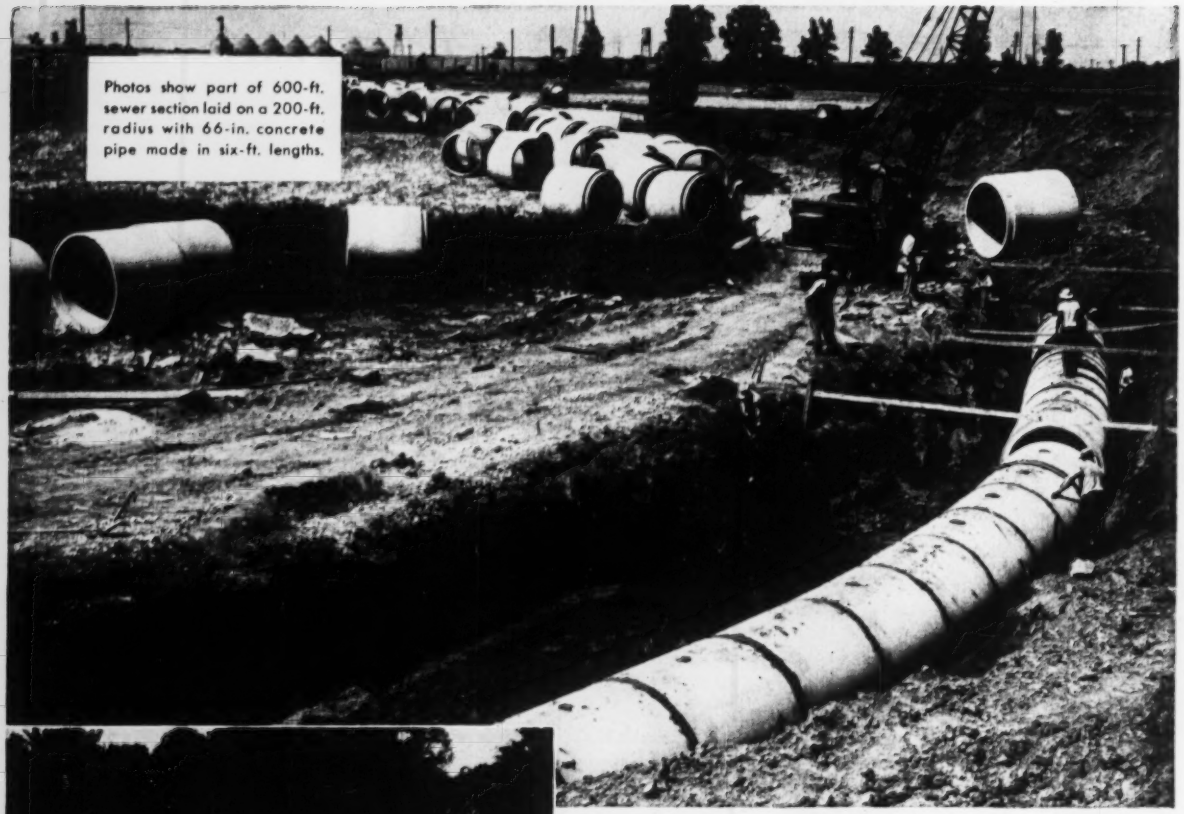
For more information about the time-and-money-saving advantages of lightweight steel flooring in bridge construction, contact the sales office nearest you.

UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
AMERICAN BRIDGE DIVISION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS I-BEAM-LOK

4-2098

UNITED STATES STEEL



Photos show part of 600-ft. sewer section laid on a 200-ft. radius with 66-in. concrete pipe made in six-ft. lengths.

New Memphis Storm Sewer Uses 13,000 ft. of CONCRETE PIPE

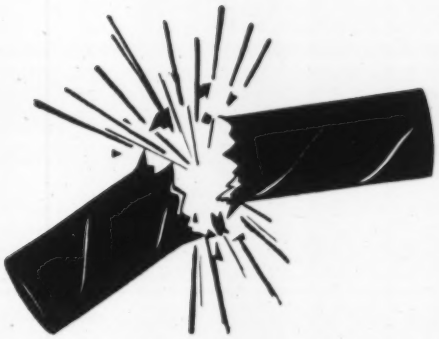
Memphis, Tenn. discovered the economy of concrete pipe years ago. That's why it was chosen for a new storm sewer just north of the Jackson Avenue Viaduct.

The photos show the installation of a portion of this sewer. About 13,000 ft. of concrete pipe (ASTM specification C76, Table I) varying from 15 in. to 66 in. were required. The pipe was laid by dragline on Class "C" bedding in trenches that averaged 12 ft. in depth. Backfill was tamped in 6-in. layers to one foot above the top of the pipe.

Engineers throughout the country know they can depend on concrete pipe for great structural strength, maximum hydraulic capacity, minimum infiltration and leakage and unusual resistance to abrasive matter. These qualities have been demonstrated in hundreds of storm and sanitary sewers all over America.

As in Memphis, engineers and taxpayers both appreciate the economy of concrete pipe. It is moderate in first cost, requires little or no maintenance and has extra long life. The result: *low-annual-cost* service.

AMERICAN CONCRETE PIPE ASSOCIATION
228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS



NEXT JULY,

how far along will you be with your mapping project?

Surveying for any large scale project can be a "short term" job that actually drags out into many months—sometimes years.

In these days of hard-to-get engineering personnel, you can avoid tieing up men for survey work and get the mapping results you want faster, by turning your mapping problems over to AERO.

Our experienced air mapping crews quickly deliver detailed, precise photomaps which serve as a valuable planning guide for many engineering projects. From these aerial photos, AERO can provide topographic maps of great accuracy. Recently AERO maps were used as a basis for earthwork on highway construction.

How much does the air method cost? Usually one-half, or less, the cost of ground surveys.

Before you begin your next project, let us discuss how AERO can save you time, money and manpower.

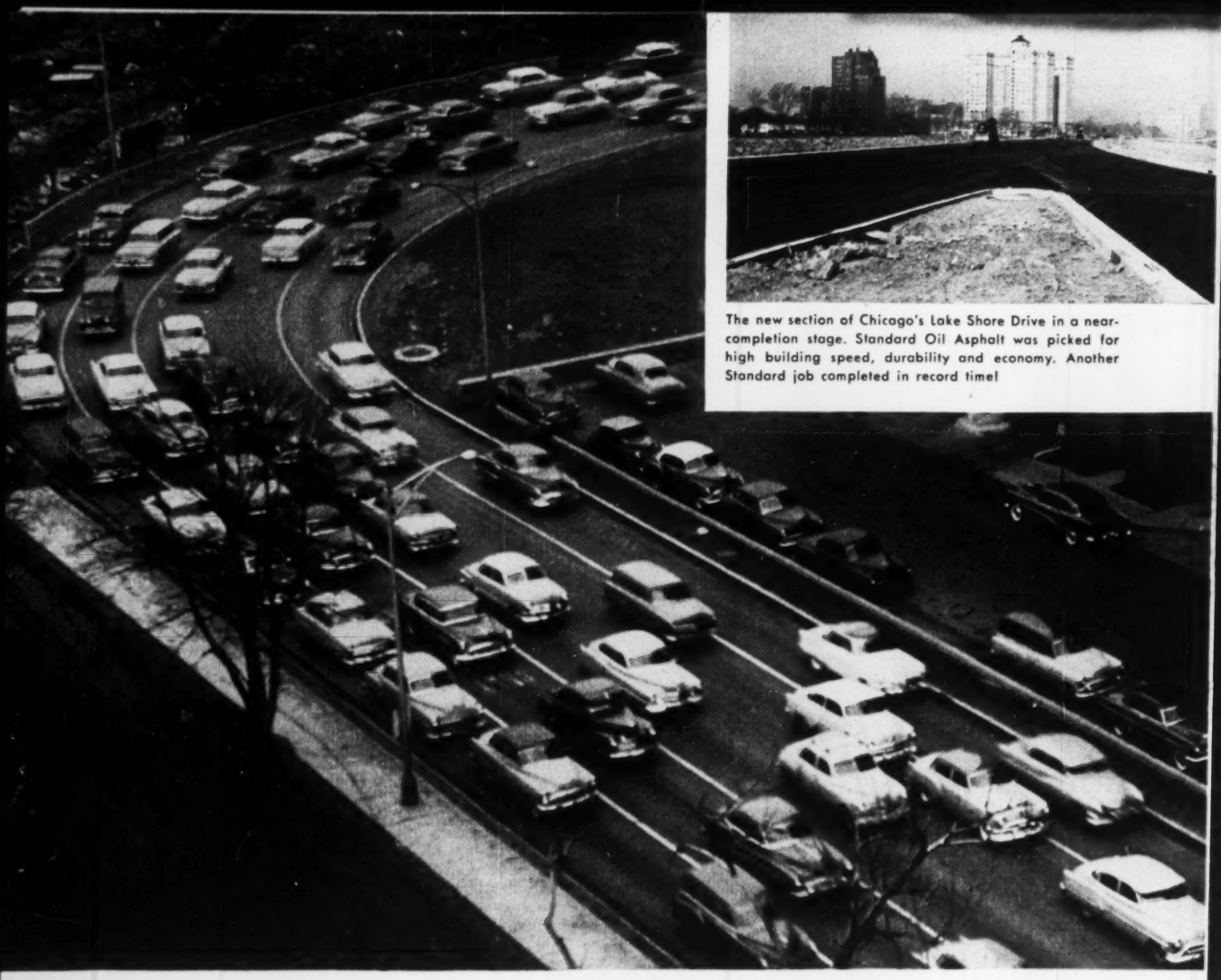
AERO SERVICE CORPORATION

Philadelphia 20, Pennsylvania

Oldest Flying Corporation in the World

AIRBORNE MAGNETOMETER SURVEYS
PRECISE AERIAL MOSAICS • TOPOGRAPHIC MAPS
PLANIMETRIC MAPS • RELIEF MODELS • SHORAN MAPPING

Affiliates:
AERO SERVICE CORPORATION *(Mid-Continent)*, TULSA
AERO SERVICE CORPORATION *(Western)*, SALT LAKE CITY
CANADIAN AERO SERVICE, LTD., OTTAWA



The new section of Chicago's Lake Shore Drive in a near-completion stage. Standard Oil Asphalt was picked for high building speed, durability and economy. Another Standard job completed in record time!

How many cars per rush hour in this new stretch of Chicago's Lake Shore Drive?

You're looking at one of the heaviest traveled big-city traffic spots in the world. When twilight hits the Windy City and the evening rush hour explodes, *100 cars per minute* jam this stretch of Chicago's Lake Shore Drive, homeward bound from the Loop.

To complete this latest link in the city's spectacular boulevard system, park officials chose Standard Oil Asphalt. Quick-laying and low-in-cost, Standard Oil Asphalt provides roads and streets that are easy to maintain and long on service. In addition to consistent quality, Standard supplies added savings through a localized system of supply. From one of its five asphalt-producing refineries located throughout the Midwest, Standard Oil makes the haul to your job a short one. Prompt, reliable shipments eliminate work delays . . . keep transportation costs at a minimum.

A specially trained Standard Oil Asphalt Representative can help you take advantage of this short haul service. He can help you select what you need to fit your local conditions. For his services phone your nearest Standard Oil office or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (*Indiana*)

STANDARD OIL
ASPHALT

STANDARD

DECEASED

John Michael Allen (A.M. '22), age 71, retired engineer of Maplewood, N.J., died on June 16. Mr. Allen was a graduate of Rensselaer Polytechnic Institute. At various periods he was in a contracting business with Thos. J. Allen, vice-president and president of the Allen Engineering & Contracting Co., Newark, N.J.; treasurer and general manager for the Di Napolia & Toriello Construction Co., Hackensack, N.J.; and superintendent of the Clinchfield Carbocoal Corp., of South Clinchfield, Va., and Newark, N.J.

Gustaf Eric Berglund (M. '40), age 61, senior civil engineer for the Sanitary District of Chicago, Ill., died on September 12. In municipal service since 1924 Mr. Berglund was with the Planning Commission for one year and then entered the Sanitary District as a structural designer. He was an alumnus of the Carnegie Institute of Technology.

Frank Leonard Bolton (A.M. '17), age 69, president of the Cayuga Rock Salt Co., Inc., Myers, N.Y., died on September 16. Mr. Bolton was connected with the firm for more than 30 years, having gone there as general manager in 1923. Earlier he was with Farley Gannett, consulting engineer of Harrisburg, Pa., and Gardner S. Williams of Ann Arbor, Mich. Mr. Bolton was an alumnus of the University of Michigan.

Ferdinand Joseph Brimeyer (M. '50), age 54, since 1941 member of the Milwaukee, Wis., firm of Brimeyer, Grellinger & Rose, died in Milwaukee, on July 3. Following his graduation from the University of Minnesota in 1925 with the architectural degree, Mr. Brimeyer became connected with the Chicago architectural firm of J. C. Llewellyn Co. From 1927 until 1941 he was a structural engineer and then partner in the firm of Kirchhoff & Rose, Architects, of Milwaukee.

Harry Benjamin Burley (M. '08), age 88, president of the Boston Insulated Wire & Cable Co., Boston, Mass., died at his home at Brookline, on August 22. Mr. Burley founded the company in 1905, and in 1916 organized a subsidary in Hamilton, Ont. He graduated from the Massachusetts Institute of Technology in 1890.

Alfred Joseph Cecot (J.M. '53), age 27, a civil engineer in the Alaska District of the Corps of Engineers, died on July 18. Mr. Cecot who received a bachelor of science degree in civil engineering from Wayne University in June 1953, had been with the Corps since his graduation.

William Daniel Chamberlin (M. '20), age 79, retired railroad engineer of San Francisco, Calif., died on August 10. In 1903 Mr. Chamberlin joined the United Railroads of San Francisco (later called the Market Street Railway), advancing to principal assistant engineer in 1909. From 1937 until his retirement in 1948 he was superintendent of the engineering and track departments.

Fritz Conway Christopherson (A.M. '31), age 56, district engineer, Water Resources Branch of the U.S. Geological Survey, Madison, Wis., died on April 14. Mr. Christopherson joined the Survey in 1924 as a hydraulics engineer, advancing to the post he held at the time of his death. He received the bachelor of science degree in civil engineering from the University of Wisconsin in 1923.

Ralph Vincent Ciccone (J.M. '50), age 29, design engineer for the Dravo Corp., Pittsburgh, Pa., died in that city on May 24. Before going to the Dravo Corp., Mr. Ciccone was with the Pennsylvania Department of Highways and the Rust Engineering Co., Pittsburgh, Pa. He was an alumnus of the Citadel and had done graduate work at the Carnegie Institute of Technology. He was a veteran of World War II and the Korean conflict.

John Belford Cleary (M. '38), age 62, consulting engineer of Bothell, Wash., died on May 12. From 1918 to 1932 Mr. Cleary was with the Midwest Refining Co. He then worked, successively, for the Standolind Oil & Gas Co., Midwest, Wyo.; the Wyoming State Board of Control; and the U.S. Department of Agriculture. He had also been general manager for the American Aggregate Co., Kansas City; superintendent for the Washington Haydite & Concrete Products Co., Bothell; and structural engineer in the Hull Division of the Everett Pacific Co., Everett, Wash.

Chester Lawton Dalzell (A.M. '42), age 43, assistant chief engineer of the Central Soya Co., Inc., Decatur, Ind., died at his home there on September 7. After graduating from Carnegie Institute of Technology, Mr. Dalzell worked for several New York City firms, including the John B. Pierce Foundation, American Houses, Inc., and Frederick Wolfe, Inc. He was also with the Proctor and Gamble Manufacturing Co., Port Ivory, N.Y., for several years.

Albert Forster Damon, Jr. (M. '11), age 81, since 1921 senior partner in Damon & Foster, engineers of Sharon Hill, Pa., died on September 8. From 1895 to 1921 Mr. Damon was in practice at Darby, Pa. He was public works bureau engineer for the Upper Darby Township for 48 years and engineering representative on the Water and Power Resources Board. He was instrumental in the establishment of the Central Delaware County, Mucknipates and Darby Creek Joint Authorities. He was an alumnus of Pennsylvania State University.

Meyer Davis (M. '18), age 68, founder and president of the Crown Engineering Company, Inc., New York, N.Y., died at his home in that city on August 27. Before organizing his company in 1922 Mr.

(*Continued on page 104*)

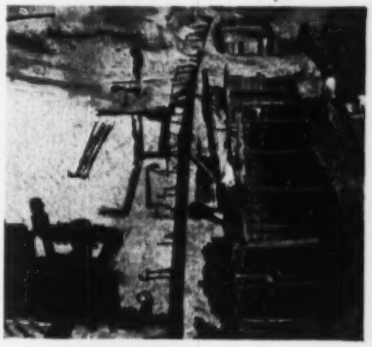
HOW TO HANDLE
WET JOBS

#23 of a Series

NEW SEA LIFE HOME FOR MARINE STUDIOS

Marineland, Fla.

Contractor: Arthur Perry, Inc.



50 POINTS, 240-ft header: What volume could be handled by a well-point system of such size, working in very coarse water-bearing sand just a few ft from the ocean? Answer below.

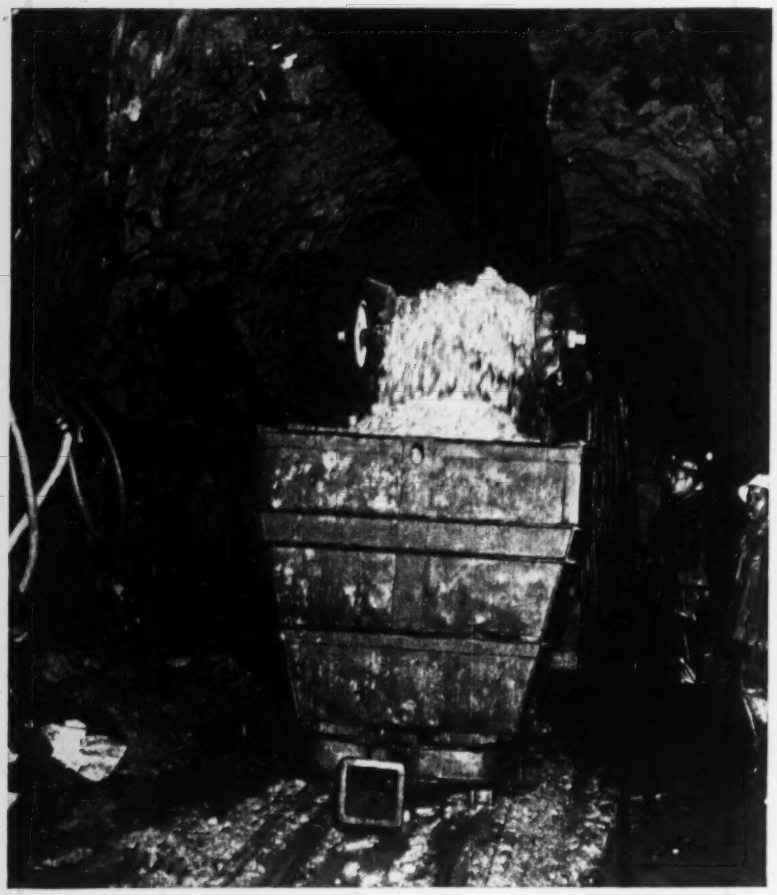
3,960,000 GALS per day were pumped round-the-clock for the life of the job—this entire flow handled by one Griffin Vac-u-matic wellpoint pump.

SUCH exceptional drainage volume—it's 55 gals per minute for each point—will surprise many contractors. Others know from repeated experience the superiority and efficiency of the Griffin system.

GRIFFIN
WELLPOINT CORP.
381 East 141st Street, New York 54, N. Y.
Hammond, Ind. Houston, Tex. Jacksonville, Fla.

In Canada: Construction Equipment Co., Ltd.
Toronto Montreal Halifax

HOW TO BREATHE UNDER WATER



Tunnels like this project under the harbor at Boston would not be possible without dependable push-pull ventilation. That's why you see so much Naylor lightweight pipe in this vital service. Its proved dependability in push-pull operation is due to Naylor's exclusive lockseamed-spiralwelded structure which provides greater collapse strength and extra safety in a light-wall pipe. Naylor's one-piece Wedge-Lock coupling makes it a simple matter to install Naylor lines in tunnel construction because it permits the line to hug the wall and joints can be made up with only one side of the line in the open. For complete details write for Bulletins No. 507 and No. 514.

NAYLOR PIPE

Naylor Pipe Company • 1281 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Deceased

(*Continued from page 103*)

Davis was connected with H. H. Robertson & Co., Pittsburgh, Pa. Mr. Davis received the civil engineering degree from Cornell University in 1908.

Edward Miall Durham, Jr. (M.'14), age 78, former railroad engineer of Clayton, Mo., and an alumnus of Lehigh University, died at Clayton on June 7. Mr. Durham was chief engineer of the Southern Railway from 1918 to 1920; assistant to the president, vice-president, and senior vice-president of the Missouri Pacific Railroad from 1924 to 1935; and chief executive officer of the Chicago, Rock Island & Pacific Railway from 1936 until his retirement in 1942.

Edwin Franklin Emmick (M. '39), age 69, road design engineer for the Washington State Highway Department, Olympia, died recently. Mr. Emmick had held various positions in the highway department, with which he was continuously connected since 1921. He attended Washington State College.

Frederic Franklin Frech (M. '53), age 62, who retired in 1952 after 35 years of service with the Corps of Engineers, died at Princeton, N.J., on July 16. Colonel Frech had served as division engineer for the North Atlantic Division, Governors Island, N.Y., and district engineer at Philadelphia. During World War II he was Air Force engineer at Philadelphia under the commander-in-chief of the Allied Expeditionary Air Forces, and Air Force engineer for SHAEF. For the past two years he had a consulting practice in Princeton. Colonel Frech graduated from New York University.

Carl Grant Graham, Jr. (J.M. '43), age 32, Major, Corps of Engineers, U.S. Army, Hillsboro, Ill., died at the Fort Belvoir Hospital, Fort Belvoir, Va., on September 15. Major Graham had been in the Corps of Engineers since 1943, when he graduated from the University of Illinois with a civil engineering degree.

Walter Birkle Hollingworth (A.M. '45), age 53, city engineer of Vernon, Calif., died at Santa Monica, on July 17. Mr. Hollingworth had been with the city of Vernon since 1938, and had been city engineer since 1950. Earlier he was connected with the Los Angeles County Assessor's Office, the Los Angeles County Flood Control District, and with several local construction firms. Mr. Hollingworth was vice-president of the Los Angeles Section at the time of his death.

Emil Frederick Jacobi (A.M. '18), age 73, retired engineer of Baltimore, Md., died on May 14. Mr. Jacobi was with the Babcock & Wilcox Co., Barberton, Ohio, from 1918 until his retirement as a structural engineer in 1950. He attended Pratt and Brooklyn Polytechnic institutes, and Cornell University.

Robert Lee Maynard (M. '38), age 56, former city manager of Eustis, Fla., died on September 13 in Orlando, which he had served as building inspector since

June. Mr. Maynard was in the Asheville, N.C., engineering department for fifteen years, serving as assistant engineer, city engineer, and superintendent of the water department. In 1941 he went to Atlanta, Ga., as office engineer for the Portland Cement Co. He had been vice-president of the Tennessee Valley Section and served on the editorial board of the *Tennessee Valley Engineer*. He was a graduate of the Georgia School of Technology.

Cleves Harrison Howell (M. '21), age 73, died on July 22 at Longmont, Colo., where he had been living recently. In 1948 Mr. Howell retired from the U.S. Bureau of Reclamation after ten years as construction engineer at Estes Park, Colo., and twelve years in other capacities. He had been chief engineer of the Middle Rio Grande Conservancy District at Albuquerque, N. Mex., and of the Los Angeles County Flood Control District. He was a graduate of the University of Illinois and Wooster College.

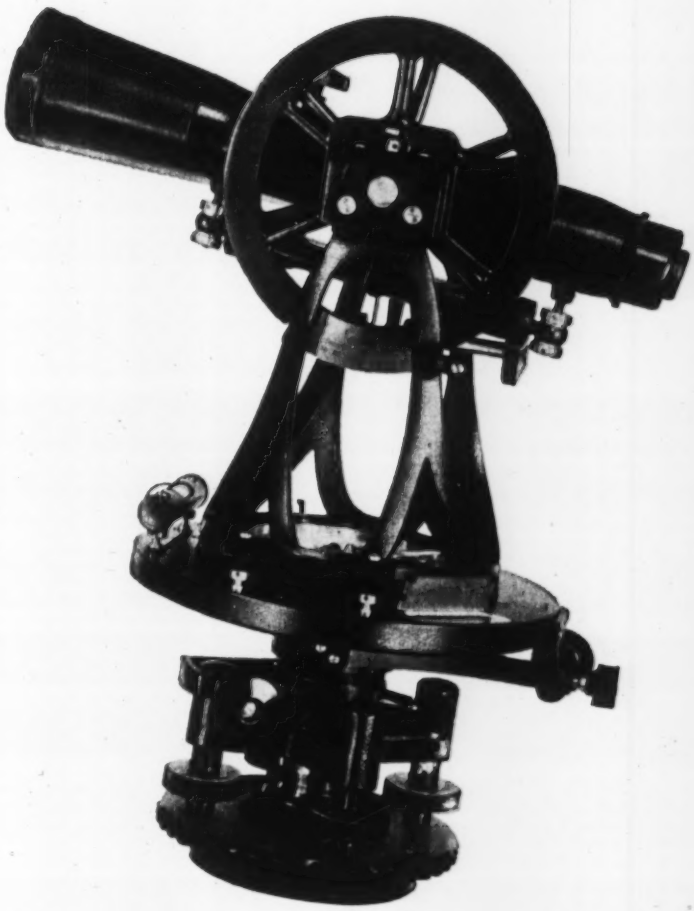
George Scott Hubbell (A.M. '04), age 89, retired engineer of Scarsdale, N.Y., died in White Plains, N.Y., on July 24. Mr. Hubbell retired in 1944 as head of the Building Department of Norwalk, Conn., following 20 years of service in that capacity. He was a graduate of Rensselaer Polytechnic Institute, class of 1886.

William Moran Hughes (A.M. '45), age 48, a partner in the excavating firm, Joseph M. Hughes & Sons, Detroit, Mich., died there on August 9. Mr. Hughes had been with the firm since his graduation from the University of Detroit in 1932.

Thomas Edwin Linton (A.M. '14), age 73, retired engineer of Palmerton, Pa., and an alumnus of the University of Kansas, died on May 15. In railroad engineering in his early career, Mr. Linton was with the Atchison, Topeka & Santa Fe Railway, the Louisiana Railway and Navigation Co., and the Kansas City Southern Railway Co. In 1915 he became chief estimator for the New Jersey Zinc Co., Palmerton—a post that he held until his retirement.

George Fong Lum (J.M. '53), age 29, project engineer for the Pennsylvania Department of Highways, Clearfield, Pa., died recently. Mr. Lum had held the position since his graduation from Bucknell University in 1953.

Rush Tabor Sill (M. '48), age 71, partner in the firm of Ruscardon Engineers, Los Angeles, Calif., died in an airplane accident near Calmilli in Lower California, on August 19. Engaged in private practice for more than forty years, Mr. Sill was a partner in Sill & Sill, mining and metallurgical engineers from 1912 to 1927; maintained an individual practice from 1927 to 1942; and in 1942 organized Ruscardon Engineers. He attended the Colorado School of Mines.



Gurley: the Lightest, Strongest Engineers' Transit

Check these features:
- ○ *As much as 25% lighter than other makes*
- ○ *Made of aluminum alloys, 30% stronger than metals usually used*
- ○ *Integral plate and standards structurally strong, rigid—no screws to loosen*
- ○ *Covered glass reticle: cross and stadia or other patterns on glass*
- ○ *Multi-groove axle and bearing prevent side play; structurally brace upper standards; keep out dust*
- ○ *Agate bearings and leaf-type tangent springs give smoothest possible motion on tangent screws*
- ○ *Reversion telescope level*
- ○ *Most accurately graduated circles of any instrument today*

GURLEY

plus

VP

Variable Power, now standard on all Gurley transits and levels, permits wide range of magnification with *one* eyepiece. Change your magnification to suit weather and light conditions. Built-in haze filter. *Write for "Facts on VP."*

W. & L. E. Gurley
518 Fulton Street, Troy, N. Y.

Imperial

THE *Finest* TRACING CLOTH

Imperial is known in drafting rooms all over the world as the traditional quality tracing cloth.

With the background of decades of experience, its makers have pioneered in modern improvements to maintain Imperial as the finest tracing cloth made.

Easy.. to handle
to drive
to locate . . .
and they're permanent!

The *New* Copperweld TRADE MARK *Non-Rusting*

SURVEY MARKERS

A thick copper covering prevents corrosion, while the steel core provides strength and rigidity for easy driving. The Copperweld Molten-Welding process makes the two metals inseparable.

At little cost, Copperweld* Survey Markers protect the investment of the original survey. They can't rust or rot, and they're simple to install—won't splinter or break. The bronze head can be readily center punched for precise reference. Want more details on this economical method for identifying survey points permanently? Write for Bulletin No. 144.

Standard length is 3 feet—other sizes made to order. Packed 10 markers to a carton.

*Trade Mark

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION • Glassport, Pa.
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

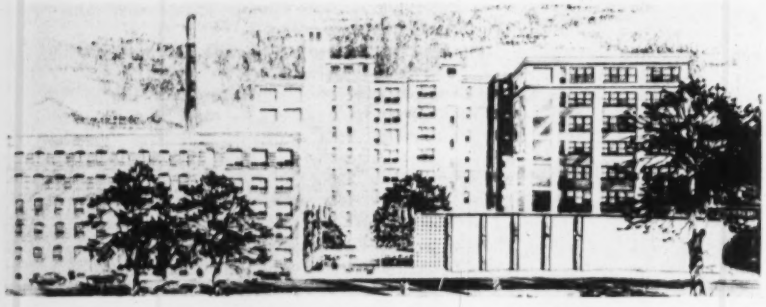
New in Education

Susquehanna University and the University of Pennsylvania have established a joint five-year curriculum enabling Susquehanna students to study engineering at the University of Pennsylvania. By taking general studies for three years at Susquehanna and engineering for two years at Pennsylvania, a qualified student can earn two degrees—bachelor of arts from Susquehanna, and bachelor of science in a particular field of engineering from Pennsylvania. Other institutions which have been participating for some time in a similar arrangement with the University of Pennsylvania are Albright, Dickinson, Franklin and Marshall, Lebanon Valley, Marietta, Muhlenberg, Ursinus and West Virginia Wesleyan colleges.

Applications for admission to Carnegie Institute of Technology were 25 percent greater this fall than for the same period last year and the highest since the 1947–1948 post-war registration of 3,972 students. More than half the students registered this semester are attending the institute's college of engineering and sciences.

A $2,000 grant-in-aid for research to be carried on during the academic year 1955–1956 at the Georgia Institute of of Technology will be awarded during the spring of 1955 by the J. C. Nichols Foundation of the Urban Land Institute. The competition is open to any man or woman who has been admitted to the Graduate Division of the Institute for study in architecture, city planning, civil engineering or industrial management. Each candidate is required to submit to the J. C. Nichols Memorial Award Committee of the Georgia Institute of Technology, Howard K. Menhinick, Chairman, 225 North Avenue, N. W., Atlanta, Ga., (no later than March 15, 1955) a specific research proposal and outline, a brief biographical sketch, and evidence of current enrollment or admission to the institute.

Industrial Plant to Be Converted to Engineering Center



As a major step toward consolidating its scattered facilities, Brooklyn Poly.echnic Institute has purchased for $2,000,000 the eight-story, block-long plant of the American Safety Razor Corp. in downtown Brooklyn. This perspective—prepared by Carson & Ludin of New York, consulting architects on the project—shows the structure as it will look when converted into a modern engineering, educational, and research institute. Fronting on Brooklyn's $80,000,000 Civic Center, the project will be close to all transit lines and easily accessible to the many evening students from Manhattan. It is expected to provide 60 percent more space than the present dispersed facilities. The two-story white limestone structure (right front) will be the Library and Student Lounge Building. A large garden quadrangle or courtyard will integrate the buildings.

CONSTRUCTION IDEA CUTS STEEL COSTS $15 TO $20 A TON

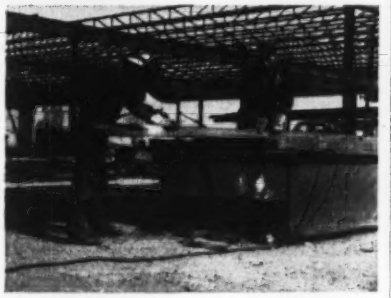


Fig. 1. *440' x 440' all welded framework for American Sterilizer Company, Erie, Pa. On-the-site fabrication cuts steel handling costs, saving an estimated $15 to $20 a ton.*

ON-THE-JOB fabrication of this 190-ton framework has saved $15 to $20 a ton compared to buying certain structural numbers already fabricated.

Standard structural members are cut to size with torches. Clips and base plates are then welded to columns with Lincoln "Fleetweld 5" electrodes using Lincoln "Shield-Arc" DC engine-driven welders.

Principal steel members are 24 inch 110 pound, wide flange beams 39 feet 3 inches long and 8 inch 31 pound columns. The members are put up with erection bolts and are field welded.

Forty-foot clear-span joists are used, welded on 6 foot 8 inch centers. Roofing is steel deck plug welded to roof joists.

Fig. 2. *Welding window frame on fixture made from 24" I beam. Framing is simply tacked to fixture before final assembly by welding.*

Fig. 3. *20 gauge steel deck sheeting is plug welded to joists through metal decking at regular intervals.*

THE LINCOLN ELECTRIC COMPANY
Dept. 2406, Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

RECENT BOOKS

Proceedings of a Conference on the Utilization of Scientific and Professional Manpower

This volume contains papers and discussion reports on the problem of the effective use of trained personnel, especially in engineering, medicine, and teaching. Aspects of the problem considered include the possible transfer of work to semi-professionals, incentives to prevent turnover, reassessment of the education and training of professionals, improved administration and leadership, and others. Throughout the volume, present utilization policies are critically examined. (National Manpower Council. Columbia University Press, 2960 Broadway, New York 27, N.Y., 1954. 197 pp., $3.50.)

Structural Design in Reinforced Concrete

This textbook, by Clifford D. Williams and Charles E. Cutts, for juniors and seniors covers general aspects of concrete, moments and shears for continuous structures, bending, and bending and direct stress. The design of retaining walls and footings, and of miscellaneous structures, including circular tanks, is considered. Prestressed concrete and concrete for ultimate stress are also treated, and there is a chapter on construction methods. (Ronald Press Co., 15 East 26th St., New York 10, N.Y., 1954. 308 pp., $6.)

Étude Théorique et Expérimentale de la Propagation des Intumescences dans les Canaux Découverts

A theoretical and experimental study of the propagation of swells or waves in open channels. After summarizing the general conditions and the classical method of calculation, the author, Jean Nougaro, presents an original graphical method based on integrated characteristic curves, points out applications related to actual experiments, and provides practical graphs for determining the rise or fall under various conditions. (France, Ministère de l'Air, Publications Scientifiques et Techniques, no. 284, Paris, 1953. 155 pp., Ffrs. 1600.)

Water Hammer
Its Cause, Magnitude, Prevention

The purpose of this book by Oscar G. Goldman, is to give engineers a solution for all cases of water hammer. Methods of calculating surge intensity and suggestions for design that will eliminate the destructive effect of the phenomenon are developed from the concept that water hammer is due to the expansion and compression of the material in which the effect is produced. (Columbia Graphs, Columbia, Conn., 1953. 116 pp., $5.)

Stauanlagen und Wasserkraftwerke
Part II: Wehre

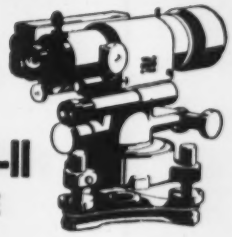
Part II of a three-part series on dams and hydroelectric generating stations, this volume, by Heinrich Press, gives a concise but comprehensive description and analysis of the various types of modern overflow dams and auxiliaries. The text is supplemented and illustrated by a wide range of examples of existing weirs. (Wilhelm Ernst & Sohn, Berlin, 1954. 204 pp., DM 26.00.)

Fluid Mechanics with Engineering Applications

The changed title of this standard text, previously issued as *Hydraulics*, reflects the generalization of the subject matter so as to apply

(*Continued on page 108*)

Another TRIUMPH for the WILD N-II PRECISE LEVEL



for Universal Application

Used by specialized surveyors in California's Sacramento Valley rice fields to produce precision-flat fields and to establish highly accurate levees on contour lines for controlling the flooding of enormous rice paddies...an engineering feat.

Because of its inherent accuracy and speed of handling, the WILD N-II PRECISE LEVEL was chosen for this specialized application by these unique surveyor-farmers.

WILD N-II is a Tilting Level, with or without horizontal circle, made for the *progressive surveyor* by the world's largest manufacturer of precision surveying instruments.

Its faster and extremely accurate results, even under adverse conditions, save costly man-hours.

- **Price $288.75 incl. metal "lunch box" carrying case.**
  Tripod Va, fixed legs, $38.00
  Tripod VIIb, extension legs, $52.25

F.O.B. Port Washington, N.Y.
Delivery from stock.

For Full Details Request Bklt. CE-11

Full Factory Service by Specialists

WILD HEERBRUGG INSTRUMENTS INC.
MAIN & COVERT STS., PORT WASHINGTON, N.Y.
POrt Washington 7-4843

Recent Books

(*Continued from page 107*)

to all fluids, including vapors and gases. Topics considered by the authors, R. L. Daugherty and A. C. Ingersoll, include fundamental concepts, fluid statics, kinematics, and dynamics, and applications in measurement, flow through pipes, flow of water in open channels, hydraulic machinery, etc. (McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y., fifth edition, 1954. 472 pp., $7.)

Elements of Structural Engineering

A textbook on analysis and detail design, written by Ernest C. Harris for non-civil engineering students. The first six chapters discuss basic principles of analysis: equilibrium reactions, shear, thrust, and bending moment, trusses and braces moving loads and deflections in beams. The last four chapters deal with the design of steel members and connections, and design in concrete and wood. Examples and problems are from mechanical, electrical and other non-civil engineering fields. (Ronald Press Co., 15 East 26th St., New York 10, N. Y., 1954. 505 pp., $7.)

Engineering Analysis

An exposition for graduate and undergraduate students of professional methods for the solution of engineering problems. Most of the book is made up of cases, drawn from electrical mechanical, and industrial engineering fields, which illustrate how to define a problem, plan an approach, check results, and draw conclusions useful in dealing with future problems. The authors are D. W. Ver Planck and B. R. Teare, Jr. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., 1954. 344 pp., $6.)

Prestressed Concrete

The three parts of this book, by Kurt Billig, cover general data and fundamentals, design of structures, and design problems. In dealing with design, loading stages, losses in prestress, deformations, ultimate strength, etc., are considered in detail. Examples discussed include girder and slab bridges, a radio tower, shell roofs, fluid storage tanks and others. Bibliographies are given after each chapter. (D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N.Y., 1952. 470 pp., $9.)

A Guide to Technical Writing

This book, designed by W. George Crouch and Robert L. Zetler, for both undergraduate students and those in industry, is concerned with the use of competent English in business letters, in technical reports, letters and articles, and in formal and informal oral communications. In the present edition the order of presentation has been altered and new specimen reports, memoranda, etc., have been added. (Ronald Press Co., 15 East 26th St., New York, N.Y., second edition, 1954. 441 pp., $5.)

Design of Concrete Structures

The present edition of this standard text, like its predecessors, covers fundamental theory and design of the customary structures. Complete designs of some common structures are included. Important changes include a revised treatment of rigid frames and new sections on ultimate design and prestressed concrete. The authors are Leonard Church Urquhart, Charles Edward O'Rourke and George Winter. (McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y., fifth edition, 1954. 508 pp., $7.50.)

Der Grundbau

A reference book for engineers and students which provides comprehensive coverage of modern theory and practice in foundation work. The author, Armin Schoklitsch, discusses practically and in detail the properties and behavior of soils, foundation materials and their behavior in water and earth, sheet piling, excavation work, the preparation of ground for foundations, special foundation types, and waterproofing. A wealth of drawings and photographs illustrates the text. (Springer-Verlag, Vienna, second edition, 1952. 457 pp., $20.70.)

Handbook of Hydraulics

Provides in compact form tables and reference data needed for the solution of hydraulic problems. Pipe formulas no longer widely used have been omitted from this edition, and a discussion of viscosity has been added. Among the numerous other changes are new material on flow through orifices and culverts, flow over submerged weirs, and rearrangement of the section on nonuniform flow in open channels. Ernest F. Brater has revised this work by Horace William King. (McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y., fourth edition, 1954. $8.)

Hydro Power Engineering

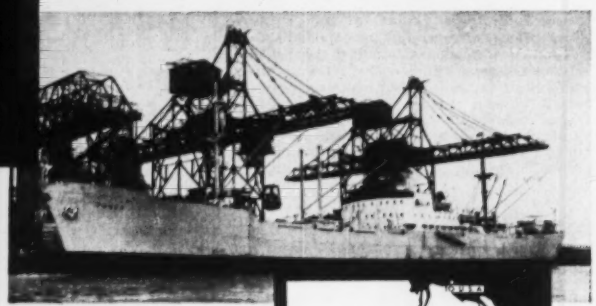
This textbook, by James J. Doland, emphasizes the practical approach to the design and preparation of plans for hydroelectric power installations. Taken up in order are fundamentals, practical routine for selecting runners, design of water passages, proper number of units, and the power station and it appurtenances. There are also separate chapters on costs and on combined hydro and steam plants. (Ronald Press Co., 15 East 26th St., New York 10, N. Y., 1954. 209 pp., $7.50.)

Mechanics of Materials

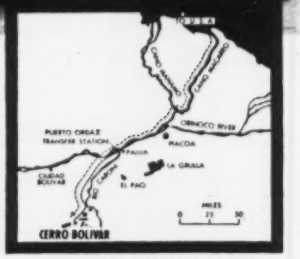
Fundamentals for a minimum course are presented in the first thirteen chapters of this text by Philip Gustave Laurson and William Junkin Cox, and additional chapters on more advanced aspects of beam and column analysis, stresses, loaded connections, etc., are included for those who wish to use them. Emphasis throughout is on the physical behavior of stressed bodies and the mathematical expression of this. (John Wiley &

happy ending of a seven year voyage

First ore from Cerro Bolivar arrives at U.S. Steel's Fairless Works



Unloading the first ore from Cerro Bolivar from the S. S. Tosca at U. S. Steel's Fairless Works, Fairless Hills, Pennsylvania.



From Cerro Bolivar 90 miles to Puerto Ordaz, at the junction of the Orinoco and Caroni Rivers, this first ore shipment moved over tracks—under which lies a Fairchild topographic map.

THE VOYAGE really began in April, 1947, when one of Fairchild's A-26 photographic aircraft, flying for the Orinoco Mining Company, four miles above the Venezuelan plains, exposed the film on which appeared the image of Cerro Bolivar—truly aerial photography's finest hour.

From Puerto Ordaz 177 miles down the lazy Orinoco, through the Cano Macareo, to the Gulf of Paria, the route of the S. S. Tosca lay through a dredged channel—the charts of the river, the dredging, and the navigational aids based on a Fairchild controlled Photomosaic map.

So the vital basic decisions have been proved sound—the long voyage is over, and the first steel has been poured.

When you make the vital decisions which may affect your company's future for generations, let Fairchild provide you with the facts!

It pays to explore with FAIRCHILD AERIAL SURVEYS, INC.

Aerial photographic, topographic, and airborne magnetometer surveys during 1954 . . . In 15 countries . . . On 5 continents.

Los Angeles, Calif.: 224 East Eleventh Street
Long Island City, N. Y.: 21-21 Forty-First Ave.
New York City, N. Y.: 30 Rockefeller Plaza
Boston, Mass.: New England Survey Service, Inc., 51 Cornhill
Seattle, Wash.: Carl M. Berry, P. O. Box 38, Boeing Field
BOGOTA—CARACAS—LIMA—RIO DE JANEIRO

Sons, Inc., 440 Fourth Ave., New York 16, N. Y., third edition, 1954. 414 pp., $5.75.)

Mémoires sur la Mecánique des Fluides

A symposium of thirty-nine papers in the field of fluid mechanics covering a wide range of subject matter; classical fluid mechanics; turbulent flow; hydraulic analogy in aerodynamics; gas dynamics; cavity flow; flow measurement; weir wave suppressor; lubrication phenomena; the use of a vertical air jet as a windscreen; etc. There are two biographical sketches of Dimitri Riabouchinsky, in whose honor the papers were written, and a bibliography of his publications. (France, Ministère de l'Air, Publications Scientifiques et Techniques, Paris, 1954. 443 pp., Ffrs. 3000.00.)

Pipe Line Corrosion and Cathodic Protection

A Field Manual

This series of twelve articles reprinted from the magazine *World Oil*, 1953–1954, covers methods for obtaining and interpreting field data and for protecting structures from corrosion. Some additional information, including fundamentals of corrosion and cathodic protection, has been added in appendixes by Marshall E. Parker. (Gulf Publishing Co., P. O. Box 2608, Houston 1, Tex., 1954. 102 pp., $3.00.)

Reinforced Concrete Reservoirs and Tanks

A practical guide to the design and construction of principally water-containing structures of plain and reinforced concrete. Complete designs are included for reservoir tanks, swimming pools, etc., and there is a chapter on construction methods and costs. In this edition additional examples are included and changes have been made to bring the text up to date. W. S. Gray is the author. (Concrete Publications Ltd., London, third edition, 1954. 169 pp., $2.80.)

Kempe's Engineer's Year-Book for 1954

An annual British publication giving explanatory technical information on modern practice in practically all fields of engineering, together with useful formulas and rules and a large amount of tabular data. Of the seventy-nine chapters in this edition, nine are new and all but one of the others, that on gears, have been thoroughly revised. A comprehensive index appears in the second volume. Edited by C. E. Prockter, under the direction of B. W. Pendred. (Morgan Brothers, Ltd., London, 59th edition, 1954. Two volumes, 75s.)

The Technical Report

Based, in part, on the 1953 symposium on the research report held by the American Chemical Society, this book discusses both the theory and practice of writing, illustrating, editing, duplicating, filing, retrieving, and using technical reports. A chapter is devoted to the oral report, and the question of security-classified reports is considered. Selected references are listed after each chapter. B. H. Weil has edited the report. (Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y., 1954. 485 pp., $12.)

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 33 West 39th Street, New York 18, N.Y.

The man behind the gun will tell you . . .

WHITE GIVES YOU
greater, longer-lasting precision–

Shown, model 7014 with "A" standard. Sold complete with tripod case and field equipment. Model 7020, same unit with "U" standard, also available.

. . . yet costs less than other quality engineers' transits

LIKE every White quality-built instrument, these engineers' transits give you greater dollar-for-dollar value than any other comparable unit.

For example: White uses a recently-developed Swiss Dividing Engine to cut graduations into solid silver. This insures super-precision from the beginning, safeguards it through more years of hard field usage.

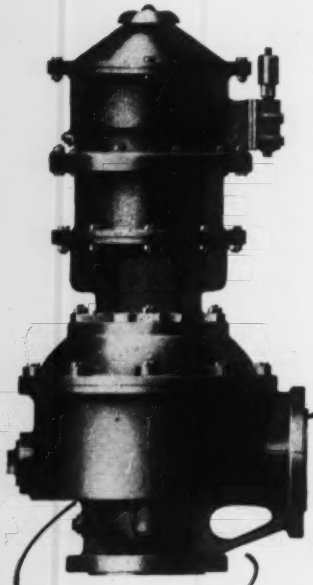
In addition, White engineers' transits give you internal focusing, covered leveling screws, and coated optics. These and a host of other design and operating features combine to give you a transit unsurpassed for ease, speed, accuracy, economy and long-lived dependability. Write for Bulletin 1053 and the name of your nearest dealer. DAVID WHITE COMPANY, 359 W. Court Street, Milwaukee 12, Wisconsin.

White Coated Optics give you an image like this...

Even at long distances under adverse weather conditions, you get a clear, sharp image — without halation.

DAVID WHITE COMPANY

We offer expert REPAIR SERVICE on all makes, all types of instruments.



New Simplex Type CCAV Valve. Combination controlled-closing and vacuum-breaking valve.

ONE 4-INCH CONNECTION to your main pipe line...

PREVENTS { **surge rupture**
vacuum collapse

Why take chances? No matter what the safety factor, surge and hammer can play some dirty tricks . . . rupture lines, blow out packing, fracture valves. And if the line breaks or is drained rapidly, it can collapse from vacuum.

Simplex Type CCAV is a new combination! A controlled-closing and vacuum-breaking valve to protect your lines against these dangers. It's easily installed, moderately priced, positive-acting.

When lines are being filled, Type CCAV Valve vents air to prevent binding, controls transfer time to prevent surge damage. Timing can be quickly set from a few seconds up to well over ten minutes—as dictated by site requirements. If hammer is excessive, Type CCAV automatically discharges water . . . extra protection for costly lines and fittings.

When lines are subject to collapse from rapid draining or line breaks, the Simplex CCAV acts quickly . . . breaks the vacuum for maximum safety.

WRITE FOR FREE BROCHURE

SIMPLEX VALVE & METER COMPANY
6724 UPLAND STREET, PHILADELPHIA 42, PA.

SIMPLEX®

VALVE AND METER COMPANY

New Publications

Metal Handbook. Lead as a construction material and other civil engineering uses of metal are treated in a recent publication of the Federated Metals Division of the American Smelting and Refining Co., which was primarily intended for the chemical engineering field. A limited number of free copies are available to engineers requesting them on company letterhead. Requests should be sent to the Federated Metals Division, American Smelting and Refining Co., 120 Broadway, New York 5, N.Y.

Surface Waters, Eastern United States. Issuance of an *Inventory of Published and Unpublished Chemical Analyses of Surface Waters in Eastern United States* is announced by the Subcommittee on Hydrology of the Federal Inter-Agency River Basin Committee. The report gives sources and an indication of the kinds of analytical data for surface waters in the East. It may be purchased from the Superintendent of Documents, Government Printing Co., Washington 25, D.C., at 50 cents a copy.

Rubber in Engineering. A broad cross section of information on rubber, written entirely from the viewpoint of the engineer, makes up a 126-page illustrated volume by W. J. S. Naunton, recently published in London by the British Rubber Development Board. Entitled *What Every Engineer Should Know About Rubber*, the booklet is available in this country at 50 cents a copy through the Natural Rubber Bureau, 1631 K Street, N.W., Washington 6, D.C.

Prestressed Concrete. Issuance of a data manual on prestressing is announced by Prestressing Incorporated, an organization formed to provide the construction industry with a practical approach toward marketing prestressed concrete construction. The manual covers structural design, construction methods, equipment, and research. Inquiries should be addressed to Prestressing Incorporated, Transit Tower, San Antonio, Tex.

Tacoma Narrows Bridge. A new volume in the series of studies of aerodynamic stability of suspension bridges with special reference to the Tacoma Narrows Bridge has been made available as University of Washington Engineering Experiment Station Bulletin No. 116, Part V. The present volume covers investigations of more general application, with major attention to the development of methods for measuring the damping on actual suspension bridges and for predicting their aerodynamic behavior from section-model tests. The continuing Tacoma Narrows Bridge investigations are being conducted by the Structural Research Laboratory of the University of Washington under the direction of the Washington Toll Bridge Authority in cooperation with the Bureau of Public Roads. George S. Vincent, M. ASCE, principal highway bridge engineer for the Bureau, is the author of Part V. Inquiries should be sent to the University of Washington Press, Seattle.

Highway Research. Announcement of two recent bibliographies in the highway field is made by the Highway Research Board, 2101 Constitution Ave., Washington, D.C. Bibliography 15 is a 95-page listing of references in the field of "Survey and Treatment of Marsh Deposits," which sells for $1.20; Bibliography 16, dealing with "Highway Finance," is priced at 75 cents.

Road Maintenance. To aid in the upkeep of unpaved roads by means of calcium chloride, the Calcium Chloride Institute has prepared a 36-page, pocket-size booklet entitled *Maintenance Tips for Unpaved Roads*. It is claimed that the proper use of calcium chloride on such roads will save about 75 percent of the aggregate replacement and blading costs and, in addition, will give a year-round dust-free, smooth-riding surface. Free copies of the booklet may be obtained from the Calcium Chloride Institute, 909 Ring Building, Washington 6, D.C.

Denver Subsoils. Important data on foundation conditions in the Denver area are reported by the Denver Section's Committee on Denver Sub-

soils in a recent publication entitled *Borehole Data and Engineering Applications in the Denver Area*. The four-year committee study reveals that the deep bed of sand and gravel underlying the area "may have large lenses of silt and clay, and thus, for the modern-day type of structural design, cannot be assumed to have adequate bearing characteristics without foundation exploration and laboratory testing." The report includes a map of the city with over 1,000 borehole locations plotted on it and an overlay showing the thickness of overburden throughout the city. It sells for $5, and may be obtained from the publisher, the Hotchkiss Mapping Co., 4055 Fox Street, Denver 16, Colo.

St. Lawrence Project. An interesting and comprehensive summary of the St. Lawrence combination power and seaway project has been prepared for the information of engineers and others by the Power Authority of the State of New York (270 Broadway, New York 7, N.Y.), to whom inquiries should be sent.

Atomic Energy. The role of industry under the new atomic energy law is emphasized in the 1954 Annual Report of the Atomic Industrial Forum, Inc., an organization of some 170 industrial firms and educational and research groups interested in the development and use of atomic energy for peaceful purposes. Inquiries should be addressed to the Forum at 260 Madison Avenue, New York 16, N.Y.

Hydrology, Los Angeles Area. In its recently announced *Biennial Report on Hydrologic Data* (No. 146) for the 1951–1952 and 1952–1953 seasons, the Hydraulic Division of the Los Angeles County Flood Control District presents information on precipitation, evaporation, runoff, dam operation, and ground water and water conservation in its area. Precipitation data include monthly records from almost 500 stations, and dam operation data show daily reservoir water surface elevation, storage, and amount of inflow and outflow for fourteen dams operated by the District. Inquiries about the report should be sent to H. E. Hedger, chief engineer of the District, Box 2418, Terminal Annex, Los Angeles 54, Calif.

Hydraulic Research. Recent hydraulic model investigations conducted by the Waterways Experiment Station are described in the following Technical Memoranda: No. 2-388, "Old River Control Structure Sediment Diversion"; No. 2-367, "Surges in Southern Outfall Sewer and Flow Conditions in State Fairgrounds (Western Parkway) Pumping Plant, Louisville, Ky."; No. 2-381, "Submergible-Type Tainter Gate for Spillway Cheatham Lock and Dam, Cumberland River, Tenn."; No. 2-375, "Spillway and Conduits for Pine Flat Dam, Kings River, California"; and No. 2-376, "Flood-Control Project for Allentown, Pa." All may be ordered from the Waterways Experiment Station, Vicksburg, Miss. Memorandum No. 2-376 is 75 cents; the others are $1.00 each.

Snow-Melting Systems. An analysis of snow-melting systems, in which heated water mixed with anti-freeze is circulated through wrought-iron pipe coils or grids embedded in paved roadways, is given in a 30-page report entitled *How Snow Melting Combats Winter Traffic Problems*. Free copies may be obtained from the Engineering Services Department of the A. M. Byers Co. (Pittsburgh, Pa.), which prepared the report.

Examinations for Professional Licensing. For the convenience of candidates for the New York State Professional Engineers License Examinations, two lecturers in review courses offered at Cooper Union—in cooperation with the college's Alumni Association—have made available manuals of problems. One covering problems in structural design was prepared by Joseph Rofman, director of the review courses, and sells for $2.50 postpaid; the other dealing with problems in engineering economics was prepared by David T. Samson and sells for $3 postpaid. Copies of both may be ordered from David T. Samson, 73-79 184th Street, Flushing 66, N.Y.

Night Visibility. Making night driving easier and safer is the aim of the nine papers included in the Highway Research Board's recent Bulletin

(*Continued on page 113*)

"We Didn't Build a Bridge, We Moved a River"...

A. S. Wikstrom, Inc.

One Sauerman Scraper helped by spreading 200 cu. yds. of muck per hour

Spreading 260,000 cu. yds. of plastic material as excavation progressed in the rechanneling of the winding Clyde River was one of the jobs done by A. S. Wikstrom, Inc., in the Thruway construction near Seneca Falls, New York.

A 6-cu. yd. Sauerman Crescent Scraper, equipped with carrier and track cable, working from a 1½-cu. yd. crane handled the job at the rate of 200 cu. yds. per hr. Length of haul was about 300 ft. An Athey Wagon served as an anchor for the track cable and provided the necessary mobility. A spud was used to support the boom and also allowed the operator to take advantage of almost the full boom height for fast gravity return of the scraper to digging point.

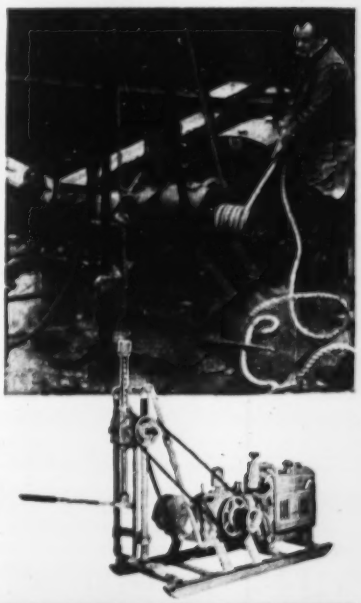
This set-up supplanted an earlier recasting arrangement using several machines. It operated at a considerable savings over previous cost.

For more details on the Clyde River project ask for Sauerman News No. 139. Request Field Report 219 and Catalog J. for specific information on the use of scrapers with boom machines. Sauerman engineers will tell you the largest Crescent scraper your dragline or tractor can handle, if you will give us the make and model number of your machine

SAUERMAN BROS., Inc.
552 S. Clinton Street, Chicago 7, Illinois

acker Portable, Power Operated Soil Sampling Rigs

Acker power operated soil sampling rigs combine into a compact, portable unit a standard power plant together with powerful hoisting winch and pump. Two models are available — Acker Model RGT for light duty and Acker RG for heavy duty service. These relatively inexpensive units are ideal for soil sampling, jetting and driving pipes or piles.



More for Your Money!

Add an Acker rotary drill head for rock coring and foundation test boring.

The Acker Model SK rotary drill head when combined with Acker RGT and RG rigs make an ideal unit for rock coring and foundation test boring. For complete information, write today for bulletin 28-CE.

ACKER DRILL CO., INC.
725 W. Lackawanna Avenue
Scranton, Penna.

A complete line of Soil Sampling Tools, Diamond and Shot Core Drills, Drilling Accessories and Equipment.

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

NEW YORK	CHICAGO	DETROIT	SAN FRANCISCO
8 W. 40th ST.	84 E. RANDOLPH ST.	100 FARNSWORTH AVE.	57 POST ST.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All applications should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

ASSISTANT SUPERINTENDENT; J. M. ASCE; veteran; married; B.S. in C.E., 1950; 3 years' experience, heavy construction. Desires position within commuting distance of New York City in general contracting organization. C-999.

CIVIL ENGINEER; J. M. ASCE; 28; married; B.S.C.E., 1951; 3 years' experience with contractor engaged in heavy construction. Field layout, planning and supervising construction, estimating, cost work. Desires position with construction or consulting firm in or adjacent to Philadelphia. C-1.

CIVIL ENGINEER; J. M. ASCE; B.S.C.E.; B.A., Sociology, emphasis labor, industry; 29; married; 1 year experience road construction and geophysical exploration; 14 months' experience irrigation, soils, hydrologic investigations; education, job experience in soils, land use planning, forestry. Desires field position in connection hydraulic, flood control, irrigation structures, hydrologic studies. Foreign location preferred. C-2-1007-A-San Francisco.

CONSTRUCTION MANAGER; M. ASCE; graduate civil engineer with 15 years' responsible contracting and engineering experience in building construction including estimating, purchasing, contract negotiation, job management, field supervision, surveys, new business, coordinating design and construction. Able executive and skilled in architect-owner-contractor and government relations. Registered. Will travel. C-3.

Positions Available

DESIGNERS AND DRAFTSMEN, experience in the design of sewer and water systems, including sewage treatment plants and water filtration and water softening plants. Part of the work will be on survey and design and the supervision of construction. Salary open. Location, eastern New York State. W-204.

CONSTRUCTION ENGINEER, 30–35, who has had some experience laying pipe lines, preferably cast iron. The job would entail considerable traveling, supervising the installation of the company's product. Salary, to $10,000 a year. Location, East. W-229.

RESEARCH ENGINEER, 35–45; civil engineering graduate, who majored in structural design; master's degree desirable. Experienced in the theory and design of structural steel; ability to write technical reports and lead discussions. Must have the ability to speak informally at meetings. Design experience in the use of reinforced concrete and other structural materials. Location, New York, N.Y. W-311.

OFFICE AND EDITORIAL ASSISTANT, civil graduate, young, with construction experience, to prepare reports, articles and reviews covering heavy construction for engineering firm. Must be good technical writer. Salary, $4,800–$5,400 a year. Location, New York, N.Y. W-356.

SALES ENGINEER, 26–35, civil graduate, with concrete experience, for technical field work with customers of cement manufacturer. Salary, $4,800–$6,000 a year. W-453(*a*).

JUNIOR ENGINEER, with civil engineering training, to develop into concrete technician and assist sales and service engineers. Training period in eastern Pennsylvania with various locations in eastern and southern states available. Salary, $3,600–$4,800 a year. W-453(*b*).

PROJECT ENGINEER, civil graduate, over 40, with at least 10 years' hydroelectric experience covering planning, design and general layout of dams, tunnels and power plant. Salary, $10,000–$12,000 a year. Location, New York, N.Y. W-460(*a*).

SALES ENGINEER, graduate civil or mechanical, young, who has had some experience in the water works field either with a contractor or consulting engineer, to sell controllers, meters and chemical feeders. Some sales experience desirable. Some travel locally. Salary open. Headquarters, New York, N.Y. W-481.

ASSISTANT CITY PLANNER, master's degree in city planning, civil, architectural engineering or social sciences, plus experience in city planning. Salary, up to $4,050 a year. Location, Connecticut. W-492.

HEAVY CONSTRUCTION ENGINEERS, young, civil graduate, interested in field construction, with above average academic records and a maximum of 5 years' experience for a long-range heavy construction program in eastern states. Initial training at home office, followed by field assignments. Applicants must be willing to relocate. Salary open. Location, Pennsylvania. W-513.

STRUCTURAL DESIGNER, for the design of complete project principally in connection with marine facilities of all types, major paper mill additions and alterations, fertilizer plants and other material handling problems. Thorough knowledge of the design of structures (steel, concrete and wood) and experience in accommodating mechanical installations into these structures. Location, South. W-526.

HIGHWAY ENGINEERS AND DESIGNERS, with at least 2 years' experience actual highway design, either with a private organization or with state highways or equivalent. Salary, $4,800–$8,400 a year. Location, Maryland. W-541.

SALES PROMOTION EXECUTIVE, 35–45, civil or mechanical graduate, with sales, sales promotion and application engineering experience covering steel products for construction industry. Salary open. Location, Pennsylvania. W-545.

ELECTRICAL MAINTENANCE AND CONSTRUCTION ENGINEER, with at least 5 years' supervisory experience for real estate management firm. Salary, $7,500 a year. Location, New York, N.Y. W-547.

DESIGNERS. One experienced in water filtration and softening plants. Three experienced in activated sludge sewage treatment plants needed by 35-year old Midwestern engineering firm where working conditions are good, with many fringe benefits, and real opportunity for interesting work and advancement. Apply by letter giving details of experience, with names of employers, years worked, salary required, and five references. Location, Midwest. W-633.

CITY ENGINEER, graduate civil, with knowledge of municipal operation. Will take charge of municipal engineering in office and field work and also work on analysis of taxes for small town of 5,000 population. Salary $5,000–$6,000. Location, South Dakota. C-2229.

CIVIL ENGINEER, B.S. degree in science, civil or architectural engineering with professional registration or minimum of 1 year civil engineering ex-

Ductube Co. Ltd., the proprietors of "Ductube" and CONTI-DUCT pneumatic rubber tubing for the most economical formation of ducts in concrete from ¾" to 7⅞" and the sole overseas concessionaires for the Gifford-Udall-CCL prestressing system wish to appoint distributors in various parts of the United States for their products. The distributors should be well connected with the building trade, willing to carry stock and employing qualified engineers who can deal with specialized types of civil engineering equipment.

Enquiries would be welcomed by

Ductube Company Limited
1 Adelaide Street, Strand
London, W.C. 2

CITY ENGINEER

Unusual opportunity for graduate civil engineer, or equivalent, with professional license, in southern Pennsylvania city. Experience is essential in land surveying, street layout, sanitary and storm water drainage, and related work. Experience is desirable in application of zoning laws and sub-division control. Successful applicant would be in responsible charge of Engineering Department, supervising survey crew and draftsmen; and would be expected to deal with the public in the many problems arising in the operation of a City Engineering Department.

Attractive salary, pleasant working conditions, permanent position for right man. No political interference. Man under 40 preferred. Reply should state age, background, and specific experience in the above mentioned fields.

Reply to Box 241,
CIVIL ENGINEERING
33 West 39th Street
New York 18, N. Y.

HIGHWAY ENGINEERS

Opportunities in Wisconsin

Expansion and Reorganization Jobs in Several Categories

Chief Bridge Engineer-Grade VI
Bridge Engineers-Grade V, IV

Highway Design, Construction and Maintenance Engineers Grade IV & V

Salary—Grade VI $687–$827
V 637– 757
IV 542– 637

Registration in Wisconsin required at Grade V and VI levels

Permanent positions—Civil Service—Liberal vacation and Sick leave—State retirement system and O. A. S. I. coverage.

Inquire by November 20

State Highway Commission of Wisconsin
State Office Building, Madison 2, Wisconsin

Highway and Bridge Designers with two to five years experience wanted for permanent positions.

Write to

Alden E. Stilson and Associates

245 North High St.

Columbus, Ohio

perience. Should be qualified as chief of party on field survey work involving construction of water and sewage facilities and/or capable of highway and bridge design. Will also consider junior or recent graduate desiring experience in these fields. Salary $4,600–$5,300 a year. Location, Midwest. D-9568.

SANITARY ENGINEER, to 50, civil engineering degree, and 5 years' experience in this field including 2 years' in supervisory capacity. Will be responsible for making area studies and preparing plans for sewers, treatment systems and water supply. Should be capable of supervising detailed plans and specifications for specific projects. Salary, $7,800 a year. Location, Midwest. D-9569.

Positions Announced

U. S. Civil Service Commission. The Civil Service Commission has announced an examination for Patent Adviser, for filling positions in various federal agencies in Washington, D.C., and vicinity, principally in the Department of the Navy. The salaries range from $3,410 to $5,940 a year. To qualify, applicants must have had appropriate college study or experience. The maximum age limit for positions paying a $3,410 a year is 35 (waived for persons entitled to veteran preference) with no age limit set on positions at higher salary levels. Full information and application forms may be secured by contacting the U.S. Civil Service Commission, Washington 25, D.C. Applications will be accepted by the Board of U.S. Civil Service Examiners, Department of the Navy, Main Navy Building, Washington 25, D.C.

New Publications

(*Continued from page 111*)

89. The papers, which range from methods of testing automobile headlights to effective median-strip planting to reduce glare, were all presented at the January 1954 meeting of the Board. Copies of the 78-page bulletin may be obtained from the Highway Research Board, 2101 Constitution Avenue, Washington, D.C. The price is $1.05.

World Power Conference. Authoritative information on world-power resources is provided in the *Statistical Year-Book of the World Power Conference* (No. 7), published by Lund Humphries & Co., Ltd., London, on behalf of the Central Office of the World Power Conference. The present volume in the annual series is devoted principally to statistics of fuel and power production, distribution, and consumption for the years 1950, 1951, 1952, and (where possible) 1953. Copies may be ordered through the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N.Y. The price is $5.85.

Blast-Resistant Building. Availability of a revised edition of the pamphlet, *A Simple Method for Evaluating Blast Effects on Building*, is announced by the Armour Research Foundation of Illinois Institute of Technology, which for the past four years has been conducting research in the field for the U.S. Air Force. Employing mathematical "models" of one-story steel and concrete buildings, the method calculates the maximum displacement of the tops of the buildings. A measure of the displacement of actual structure is obtained by analyzing the behavior of mass and spring of the building as represented in the model. The booklet may be ordered from the Propulsion and Structural Research Department, Armour Research Foundation of Illinois Institute of Technology, Chicato 16, Ill. The price is $3.

AIRCRAFT ENGINEERS

With Experience

WANTED AT

GRUMMAN

LAYOUT DESIGNERS
Airframe Structures
Equipment Installations

FLIGHT TESTING
Planners
Analysts

HYDRAULICS
Systems Design
Testing

STRUCTURES
Stress Analysis
Static Testing

RESEARCH
Computer Engrs.—Digital or Analog
Vibration & Flutter Engrs.
Dynamic Analysis—Systems Engineers

ARMAMENT INSTALLATION
AERODYNAMICS
INSTRUMENTATION
STANDARDS ENGINEERS

TOOL DESIGNERS
TOOL PLANNERS
CHEMICAL ENGINEERS

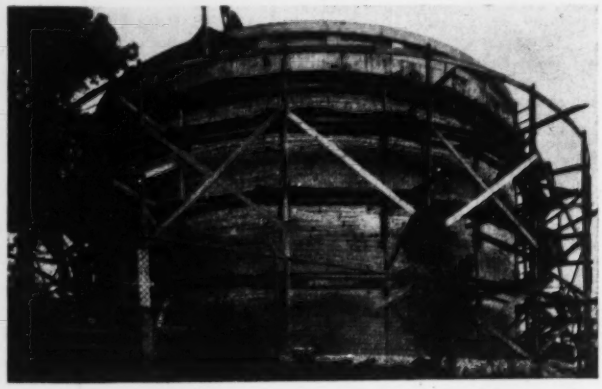
Metal Cleaning, Plating

Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship Required

APPLY IN PERSON
OR SEND RESUMÉ TO:
Engineering Personnel Dept.
INTERVIEWS AT
Employment Office
South Oyster Bay Road
North of Railroad
Monday thru Friday
8:30–11:30 AM; 1:30–3:30 PM

GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.



CEMENT GUN COMPANY PRE-STRESSES AND RESTORES *EXISTING* WATER TANK

The progress picture above shows a stage of our repair work on a concrete water tank in New England. This tank was completely lined with reinforced "GUNITE" to stop seepage which had caused serious disintegration to the exterior of the tank. The entire outside of the tank was subsequently chipped and existing hoop rods exposed.

To strengthen the tank, wedges were driven behind the rods to take up the slack. This placed the rods in tension and the concrete in direct compression. Wire mesh was then attached to the reinforcing rods and the entire tank treated with two inch mesh reinforced "GUNITE."

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin B 2400. We will gladly send a copy at your request. On your letterhead please.

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES – ALLENTOWN, PA., U. S. A.

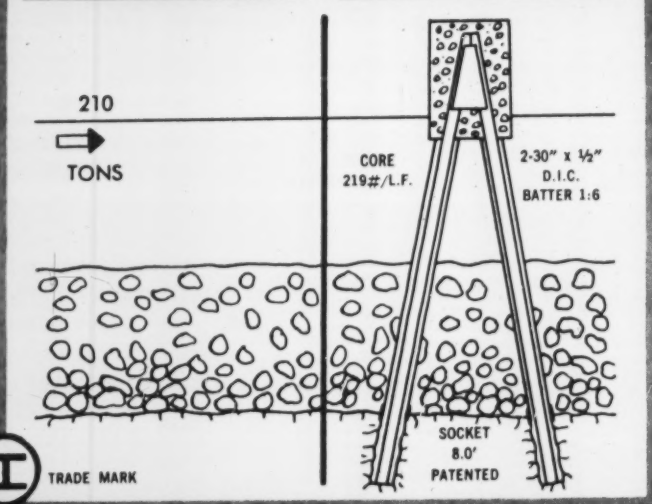
MANUFACTURERS OF THE CEMENT GUN

LOCKED IN THE ROCK

DIFFICULT FOUNDATIONS

PROBLEM

SOLUTION



DRILLED-IN CAISSON CORPORATION

2 PARK AVENUE, NEW YORK 16, N. Y. • ORegon 9-2082

Affiliated with SPENCER, WHITE & PRENTIS, NEW YORK • WESTERN FOUNDATION CORP., NEW YORK

Applications for Admission to ASCE, September 11–October 9

Applying for Member

ALLEN RAYMOND BACON, The Dalles, Oreg.
HARRY SCHOOLFIELD CURLIN, Mayfield, Ky.
HECTOR A. DELIZ, Santurce, Puerto Rico.
ROY JOHN AUGUST ERICKSON, Philadelphia, Pa.
CLARENCE WILLIAM EWING, Harrison, Va.
FRANCIS HOWARD FALKNER, Washington, D. C.
KARL EMIL FRANZ FIEBINGER, New York, N. Y.
JOE J. FISHER, Los Angeles, Calif.
LEE ROY HENNING, Los Angeles, Calif.
LESLIE ERNEST HUNTER, London, England.
TILMAN JULES, Los Angeles, Calif.
EMIL JACOB KRATT, Matthews, N. C.
EUGENE GREENE LAWLEY, Detroit, Mich.
HUBERT CECIL MAJOR, Birmingham, Ala.
DAVID VERNON MESSMAN, Knoxville, Tenn.
GEORGE MELVIN MILLER, Baltimore, Md.
MUHAMMAD HUSSAIN MINHAS, Lahore, West Pakistan.
HARISH CHANDRA MUKERJI, Calcutta, India.
NIKITA VLADIMIR PODRUTSKY, New York, N. Y.
ERIC HENRY WANG, Xenia, Ohio.
MAHAVIR PRASAD, New Delhi, India.
ROBERT STANLEY REID, Detroit, Mich.
PAUL ROBINETT RUSSELL, Cincinnati, Ohio.
HARALD TULTS, Chicago, Ill.
MADISON BRAY WATHEN, Willoughby, Ohio.

Applying for Associate Member

ROBERT NEWTON CAMPBELL, JR., Mobile, Ala.
ELMER ALLAN CLEES, Olympia, Wash.
WILLIAM DUNCAN CRAWFORD, JR., Pittsburgh, Pa.
ANGELO DALCERRO, Tucson, Ariz.
CHARLES LEWIS DANIEL, Jackson, Miss.
MICHIEL DANIEL DU PREEZ, Transvaal, South Africa.
WILLIAM WESLEY ECKENFELDER, JR., Ridgewood, N. J.
DONALD ELMER JOHNSON, Covina, Calif.
TRUMAN ROSS JONES, JR., College Station, Tex.
DAVID EARL KING, Azusa, Calif.
WILLIAM GUS KOULAS, Kansas City, Mo.
FREDERICK ERNST KRAUSS, Cleveland, Ohio.
FRANK NORRIS LEATHERWOOD, El Centro, Calif.
ALFRED COCHRAN LEONARD, New York, N. Y.
ELIAS ARZE LOYER, Chile, S. A.
MILTON MAY, Minneapolis, Minn.
ROBERT LOUIE MUELLER, Denver, Colo.
CLIFFORD MARION PARRISH, Lubbock, Tex.
ALBERT WALTER REYNOLDS, JR., San Antonio, Tex.
ERNEST CHARLES ROEMER, JR., Tallahassee, Fla.
JOHN JAMES ROLAND, New York, N. Y.
GORDON MICHAEL ROSE, Toronto, Ont.
CHESTER EDWARD SCHMIDT, Milwaukee, Wis.
EARLE THOMAS SNODGRASS, Hanover, Ind.
JOHN HENRY STAUFF, Berkeley, Calif.
ARTHUR SWAJIAN, Los Angeles, Calif.
SELLATHURAI EDMUND THAMBYAH, Jaffno, Ceylon.
BENDT WEDELL, Chicago, Ill.
ROBERT FURBER WINSTON, Jackson, Tex.

Applying for Junior Member

STANLEY MARTIN ALTMAN, Kansas City, Mo.
NICHOLS NICHOLAOS AMBRASEYS, Athens, Greece.
HENRY BENJAMIN ANDERSON, JR., Kansas City, Mo.
DANIEL FRANCIS BECKER, Kansas City, Mo.
JAMES ALBERT ERIKSON, Chicago, Ill.
PAUL STANLEY GILLAN, Redington Beach, Fla.
ROBERT SANDOR GREER, Kansas City, Mo.
SWEILEM MUSA HADDAD, Rochester, Pa.
ALBERT CHARLES JAGGER, Sydney, N.S.W., Australia.
ARNOLD CALVIN JONES, Napa, Calif.
GEORGE JERRY LUSICH, JR., Sacramento, Calif.
HOWARD GLENN MEARES, JR., Hemet, Calif.
WILLIAM THOMAS PATTERSON, Baltimore, Md.
CHAUDHARY MOHD ABDUL RASHID, Lahore, West Pakistan.
OTTO ALBERT REES, New Orleans, La.
DAVID IRVING SCHULTZ, New Orleans, La.
CHARLES MILTON SPOONER, JR., Weirsdale, Fla.
JOHN FRANK TANNER, San Diego, Calif.
DOUGLAS IVER TILDEN, Tulsa, Okla.
JAN ADRIANUS VELTROP, Chicago, Ill.

[*Applications for Junior membership from ASCE Student Chapters are not listed.*]

UNDERWATER SURVEYS
MADE EASIER

Fast...accurate and permanently recorded

SURVEY DEPTHOMETERS
•
RADIO TELEPHONES
•
DIRECTION FINDERS
•
RADAR

Bludworth Marine's Supersonic Survey Recorders make underwater surveys faster with exceptional accuracy. A must for channel dredging, salvage or coastal construction. Reveals character of bottom material while recording depth.

BLUDWORTH MARINE

Precision built electronic navigation equipment since 1926

92 Gold Street, New York 38, N. Y.

DIVISION OF NATIONAL — SIMPLEX — BLUDWORTH, INC.

10 DAY FREE TRIAL

On a WARREN-KNIGHT Transit

MODEL 7-cF
$675.00

The superior accuracy of a Warren-Knight is our most envied possession. It is achieved by the skilled hand craftsmanship of guild instrument makers. That's why a Warren-Knight is most prized by so many engineers and constructors.

How a Warren-Knight saves time and money!

- Sturdier construction for longer life.
- Extra reinforcing for rough handling.
- Extra fine coated lenses—close focus 4½ feet—for convenience.
- Disappearing Stadia to eliminate errors.
- Graduations differentiated size and slant for sure reading.
- Right angle peep right through telescope angle to save time.
- Non-cramping leveling head for ease of handling.
- Replaceable leveling screws for low maintenance.
- Leveling screw threads covered to eliminate dirt.

Send for free catalog CE 411

WARREN-KNIGHT

136 NORTH 12TH STREET PHILADELPHIA 7, PA.

GET WINTER CONCRETE with HIGH EARLY STRENGTH by using

SOLVAY CALCIUM CHLORIDE

- **Lower Costs!**
- **Saves Time Between Operations!**
- **Permits Quicker Finishing!**
- **Cuts Protection Time!**
- **Assures Full Ultimate Strength!**

Today—with SOLVAY Calcium Chloride, it is both possible and practical to carry on concreting operations during the winter months. The addition of SOLVAY Calcium Chloride assures fast setting to permit quick finishing, full ultimate strength and a short protection period—even in freezing weather.

Whether you do your own mixing or use transit-mix concrete, you will be sure of quality work, minimum cost and faster operation if you are sure that your specifications include: 1. The use of heated water and materials. 2. The use of SOLVAY Calcium Chloride in the mix. 3. The use of proper covering or protection against anticipated temperatures.

Send for FREE BOOK Containing Full Details!

"The Effects of Calcium Chloride on Portland Cement" is filled with important information and answers to your questions about the use of calcium chloride in concrete. Mail coupon below for your copy.

When ordering
READY MIXED CONCRETE IN COLD WEATHER
Be sure to *Specify*
SOLVAY
Calcium Chloride

Allied Chemical

SOLVAY PROCESS DIVISION

Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

Please send me without obligation your book, "The Effects of Calcium Chloride on Portland Cement."

Name .....

Company ..... Position .....

Address .....

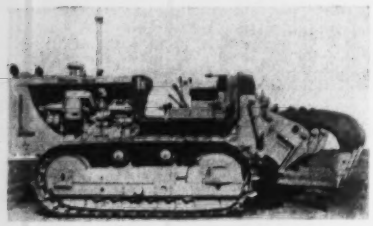
City ..... Zone ... State CE-11

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Rock Ripper

ADDING TO ITS line of earthmoving equipment, the Greenville Steel Car Co. under license from the American Tractor Equipment Corp., is now manufacturing the ATECO rock ripper. The rock ripper, made exclusively for use with the Caterpillar D-8 tractor, is designed for fast



ATECO Rock Ripper

demolishing of all kinds of road surfaces in road repair or rebuilding projects. Hydraulic-powered, it has replaceable rock points designed with splitting wedges and an underground "quiver" of curved standards that expedites shattering rock and shale. **Greenville Steel Car Co., C. E. 11-116, Greenville, Pa.**

Transit-Level

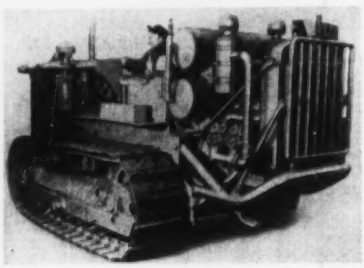
IMPORTANT IMPROVEMENTS IN the Warren-Knight Transit-Level No. 38/39 make it especially useful to builders and contractors. In place of the external focusing 22 power telescope, the recent model now has an internal focusing telescope of 24 power. An improvement in the telescope is the use of glass reticle. Making for a sturdier instrument is the new one piece U-shaped standard and circular reinforced top plate. It also has a $3^3/_4$-in. vertical arc and an improved leveling head which completely covers and protects the leveling screws. **Warren-Knight Company, C. E. 11-116, 136 North 12th St., Philadelphia 7, Pa.**

Motor Grader

AN IMPROVED NO. 12 Motor Grader that packs 115 hp and increases speed to 4 mph in second gear and 21.5 in sixth gear has been announced. The clutch and transmission also have increased capacity to match the greater horsepower. In both the No. 12 and No. 112 a convenient one-lever starting from the seat is now possible. Both models are equipped with accelerator-decelerator pedals that permit changing speeds without changing the throttle setting. **Caterpillar Tractor Co., C. E., 11-116, Peoria, Ill.**

Tractor Mounted Drilling Units

THE RECENTLY DEVELOPED tractor mounted drilling units save on equipment, time and manpower by eliminating the centralized air plant and attendant and the compressed air pipeline. These self-contained units also avoid the possibility of air line breaks due to freezing, blasting, back breaks and collisions. Due to the mobility of the unit actual drill time is increased and operator fatigue is reduced. The units require only a one to two man drill crew, eliminating the need for several men to move the compressor and drill wagon. Such a unit usually consists of a track-type tractor with large front idlers, rear-power take-off to drive the compressor, one or two rock drills with six or twelve foot feeds, an air receiver of sufficient volume, and a compressor unloader and engine throttle control. In addition, a two stage air compressor is required and occasionally a front cable control is used to adjust the drill mounting. For wet drilling a water tank is mounted over one of the tracks, water pressure being ob-



Track-type Drilling Unit

tained by a small air line from the air receiver. The rigid support given by the hydraulic boom type operation has proven useful in ditch drilling, face drilling, and for other points not accessible to the tractor. **Caterpillar Tractor Co., C. E. 11-116, Peoria, Ill.**

Polyethylene

POLYETHYLENE, A PLASTIC found in countless forms in supermarkets, now invades the construction field. The Visking Co., is now marketing a .004 in. thick sheet which can be used effectively as a vapor barrier and moisture seal. There are, of course, many other ways in which the thin impervious film can be used. The product, called Visqueen, comes in rolls 16 ft wide and 100 or 300 ft long. Its weight is 20 lbs per 1000 sq ft for the 4 in. thickness. Cost of the product ranges from 1 $^1/_2$ to 1 $^3/_4$ cents per sq ft and it costs about $^1/_2$ cents per sq ft to place. **The Visking Corp., C. E. 11-116, P. O. Box 1410, Terre Haute, Ind.**

Utility Compressor

A NEW UTILITY compressor has several improved features including better air cleaning, and cooling through the use of oil bath air cleaners and a pressurized cooling system. The same basic engine is used however. It is built up under one housing including an upright air receiver. This space-conserving feature makes the Utility ideal for mounting crosswise behind a truck cab allowing plenty of extra room for other equipment and materials. Overall width of the unit is only 25 in. and the length of 82 in. does not exceed the maximum truck with regulation for any state. The 105 utility is lighter and more compact than any standard skid mounted 105. These physical features of the compressor combined with a strong lifting eye in the center of the hood top make it easy to move from level to level on an erecting job. Also, by using the lifting bail, the Utility can be moved from a truck and back again very quickly. No disconnection or disassembly is required. All controls and the instrument panel are conveniently located on the "curb side." Water, gasoline, and oil filler necks all protrude from the hood top for easy filling without removing the light-weight grill type hood sides. **Westinghouse Air Brake Company, CE 11-116, Milwaukee 14, Wis.**

Truck Mixer

DESIGNED TO MEET the demand for a big truck mixer that can be mounted on a short wheel base truck is the new Model M, which is now being produced. This type mixer conforms to axle weight limitation and the location of the mixer trans-

Model M Mixer

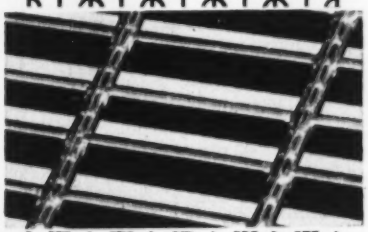
mission reduces the truck cab to axle requirement by 20 in. and permits easy access to the transmission. The $4^1/_2$ cubic yd model shown here is one of three in the Model M series, which are rated $4^1/_2$, $5^1/_2$, and $6^1/_2$ cubic yd capacity. All models are guaranteed to mix $^1/_2$ cubic yds more than rated capacity. **Blaw-Knox Co., Blaw-Knox Equipment Division, C. E. 11-116, Pittsburgh 38, Pa.**

You Get
MORE THAN GRATING
When You
SPECIFY IRVING

YOU GET...
Over 50 years of engineering skill and production know-how from the FOUNDERS of the open-grid flooring industry.

YOU GET...
A "fitting" grating for every purpose.

YOU GET...
Riveted, pressure-locked and welded Irving gratings in steel; and Irving aluminum gratings in riveted and pressure-locked types, designed for your industrial flooring problems.



YOU GET...
Irving engineering procedures which assure precisely fabricated panels designed from your floor plan or sketch for quick, easy installation.

YOU GET...
Prompt delivery anywhere.

IRVING SUBWAY GRATING CO., INC.
ESTABLISHED 1902

OFFICES and PLANTS at
5008 27th St., Long Island City 1, N. Y.
1808 10th St., Oakland 20, California

Equipment, Materials & Methods (Continued)

Shovel-Crane

THE LS-68, A light ¾-yd shovel-crane which replaces the popular LS-52, is being manufactured. Offering all advanced features, the LS-68 includes Speed-o-Matic power hydraulic controls. Important additions of the new shovel-crane are its wide lower frame and the steel single-flange track rollers. The lower frame permits the use of 24 in. or 30 in. shoes, which provide a maximum ground bearing area of 47 sq ft. To assure superior friction action

LS-68 Shovel Crane

alloy cast iron clutch shells are used because of the separated drum gears and clutch shells. Six conical hook rollers and a convertible crawler-base rig are other features of the LS-68. **Link-Belt Speeder Corp., C. E. 11-117, Cedar Rapids, Iowa.**

Surface Roughness Scales

NEW CYLINDRICAL SURFACE roughness scales, designed as a standard of comparison by sight and touch for internal and external curved surfaces, have been developed. Scale number one is capable of determining the surface roughness of 10 specific surfaces, an example of which would be that produced by grinding, lapping or honing and superfinishing in the 4, 8, 16, 32, and 63 micro-inch categories. On scale number two, typical surfaces such as those produced by lathe and screw machine operations in the 16, 32, 63, and 250 micro-inches are represented by twined and bored surfaces. The new scales provide a standard objective reference by which one can designate the roughness and appearance of numerous finishes required. **The General Electric Co., CE 11-117 Schenectady 5, N. Y.**

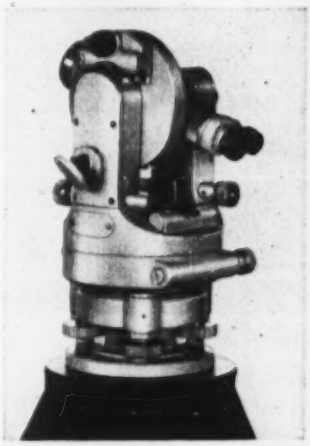
Colorama Pencils

COMPLETION OF AN entirely new line of colored pencils with 50 startlingly vivid colors and a variety of unique assortment boxes is announced. Special emphasis was placed in providing a pencil which possessed a sturdier, longer-wearing lead with absolutely uniform, brilliant color, smoother coverage and a minimum of waxiness. The result is a highly versatile colored pencil which sacrifices no property in favor of another to gain the ultimate in performance. **Eberhard Faber Pencil Co., CE 11-117, 37 Greenpoint Avenue, Brooklyn 22, N. Y.**

SURVEYING NEWS

NEW THEODOLITE SETS UP QUICKLY, EVEN IN THE WIND

Has this been your problem? Now—old-type mechanical plumb-bob replaced by can't-miss optical principle



- Improved Theodolite reads horizontal and vertical circles simultaneously, through same eyepiece
- Reads direct to 1 min. with no matching of lines—no parallax
- Amazingly blur-free—small, compact, moisture-proof, dust-proof.

Mail this coupon for details

FENNEL
INSTRUMENT CORP. OF AMERICA
11-27 44th Rd., LONG ISLAND CITY, N. Y.

Please send me Booklet C with information on Fennel . . .

- ☐ Double bubble
- ☐ Other levels
- ☐ Transits
- ☐ Combinations
- ☐ Theodolites
- ☐ Alidades
- ☐ Collimeters
- ☐ Stands
- ☐ Tripods
- ☐ Repair of present instruments, (any make)

NAME.....

ADDRESS.....

What Do You Need of STEEL!

FLINT . . . your one-stop steel center will give you prompt delivery on most any kind of steel you need. Delivery can usually be made from stocks of:

GALVANIZED STEEL
for switch yards, substations, transmission towers, buildings, etc.

INDUSTRIAL STEEL
for buildings, plants, bridges and other heavy construction.

PLATE STEEL
for petroleum processing and chemical plant equipment, LP Gas and anhydrous ammonia tanks.

WAREHOUSE STEEL
for rolled bars, plates, structural shapes, and all other warehouse items.

PHONE WIRE WRITE

A Complete Service: STEEL • FABRICATION • ERECTION • DETAILING

Serving Southwest Industry Since 1915

FLINT STEEL **FLINT STEEL CORPORATION**
TULSA • MEMPHIS

. . with this

F & E INCINERATOR STOKER

Patents Pending

F&E Incinerator Stokers apply not only to new incinerator plants, but to many new existing furnaces. Results—up to 50% increased burning capacity; big reduction in labor; big reduction in maintenance.

F&E FLYNN & EMRICH CO.
301 N. Holliday St. ★ Baltimore 2, Maryland

Equipment, Materials & Methods (Continued)

Rotary Snow Plow

SPEEDY, INEXPENSIVE SNOW removal is possible with a new rotary snow plow that mounts on most wheel-type tractor front-end loaders, replacing the loader bucket and using the same pins. The unit, which is called the Bros Series "A" Rotary, can handle deeper snow than many 300-hp plows though operating on only 30 hp. Important features include the Bros Sno-Flyr principle that permits casting snow at the rate of three to four tons a minute and a rotating chute that makes it possible to load on either side of the truck. In actual operation, the Series "A" can load a 5-yd dump truck in 30 sec compared with the 5 to 10 min required for hydraulic front-end bucket loaders. Easily convertible from snow plow to bucket, the unit offers the economy of year-round operation. It is available in three plowing widths: 4 ft 4 in., 5 ft 6 in. and 6 ft 6 in. It may also be obtained for mounting on four-wheel-drive jeeps and can be furnished with special hitch applications. **Wm. Bros. Boiler & Manufacturing Co., C. E. 11-118, Minneapolis, Minn.**

Blueprint Rack

WIDELY USEFUL TO engineers, contractors, and architects is a new blueprint rack called the "Glider." An important feature of the unit is a specially designed clamp that eliminates the need of punching holes in each set of prints and holds any thickness of set securely. The special clamp accommodates any size print and can hold up to 100 sheets. Thumbscrew adjustment assures easy insertion or removal. Of all-steel construction, the "Glider" can easily be taken apart for shipment and reassembled for use on a new project. The standard model, 5 ft high, 4 ft wide and 3 ft deep, holds from 12 to 18 sets of drawings, and extension units may be added to it. It sells for $89.50. A deluxe cabinet style is also available. **Momar Industries, C. E. 11-118, 4323 West 32nd St., Chicago 23, Ill.**

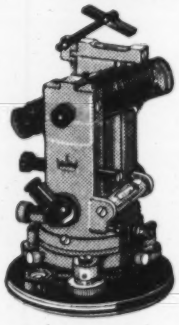
Disc-Type Brakes

TRU-STOP DISC-TYPE emergency brakes, used as standard equipment on trucks and buses, are now being installed on 34,000-lb tractor-loaders. Two of the brakes are used for track and parking purposes, and a third in the bucket operating mechanism. This type of brake out-performs and outlasts drum-type brakes which have a greater lining area, according to automotive engineers. This Eimco 105 tractor-loader also features a new transmission containing all gearing and clutches for speed changing and full, independent reversal of each track in one compact unit. **American Chain & Cable Co., Inc., C. E. 11-118, 929 Connecticut Ave., Bridgeport 2, Conn.**

ASKANIA

MIDGET OPTICAL READING

TRANSIT TK



with
erecting eyepiece
and
optical plummet

HANDY
EASY
EFFICIENT
HIGHEST
PRECISION

Direct reading to 12″
Estimation to 5″
Instrument Weight 4 lbs.

★ LOW COST

ASKANIA-WERKE AG
Berlin • Friedenau

REPRESENTATIVE
GEO-OPTIC COMPANY INC.
170 BROADWAY, NEW YORK 38, N. Y.

CATALOGUE ON REQUEST

foundations piling

underpinning shoring

cofferdams special services

SPENCER, WHITE & PRENTIS INC.

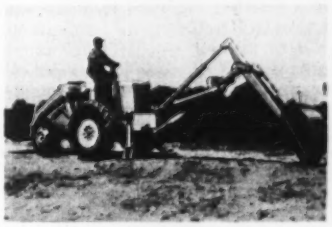
10 EAST 40TH STREET, NEW YORK 16, N. Y.
Detroit: Newsome Bldg. • Chicago: 134 So. La Salle St.
Washington, D. C.: Tower Bldg.

SPENCER, WHITE & PRENTIS OF CANADA, LTD.
Toronto: 700 Bay St.
Montreal: 2052 St. Catherine St., West

Equipment, Materials & Methods (Continued)

Hydraulic Back-Hoe

AN HYDRAULIC BACK-HOE, has been designed to apply tremendous digging power, combined with fast retracting action, to speed up the entire operating cycle. Digging speed is increased by the "wrist-action" bucket because the hoe does not have to go through the complete cycle. The boom design and bucket action permit digging vertical bell holes, vertical side walls, square corners and maintain a smooth, level grade at the bottom of trenches. The ability to dig trench and dump spoil at any radius up to 190° is another design feature. **The Wain-Roy Corp., C. E. 11-119, Hubbardston, Mass.**



Hydraulic Back-Hoe

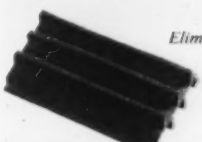
Survey Markers

NEW NON-RUSTING, copper-covered steel markers, which will locate survey points permanently are now available. Each marker consists of a strong steel core to which a thick copper covering is molten-welded, providing strength for easy driving without splintering. There are two types: a tinned-end marker, which has high visibility, and a unit with $1\frac{1}{2}$-in. dia bronze head that provides ample space for center-punching the precise point of reference and can be driven flush with the surface. The survey markers can be located easily by using a dip needle, if they are buried a few inches under the surface. **Copperweld Steel Co., C. E. 11-119, Wire and Cable Division, Glassport, Pa.**

Wall Tie and Mortar Trough

TO SPEED CAVITY wall construction the Rock-Fast Cavity Wall Tie and a sturdy metal trough are now on the market. This Tie performs the double job of spreading and tying parallel masonry walls. The metal trough hangs between the walls during bricklaying operations to catch extra mortar and prevent formation of bridges. Each tie has a 3-in. wing at either end and 6-in. or 8-in. stems. Troughs are available in 36-in. lengths. **Conver Steel & Wire Corp., C. E. 11-119, 600 E. 132nd St., New York 54, N. Y.**

• Quickly accepted by the nation's leading engineers and contractors, Labyrinth Waterstops—the first really satisfactory water seals—are now being used on all types of jobs... hydro electric plants, atomic energy plants, industrial plants, water and sewage plants, water reservoirs, underground and surface parking lots, swimming pools plus a host of lesser projects. (Names, and details furnished on request.) Why not get additional information on this time and money saving water seal? Just mail coupon below.



Eliminates seepage problems. Simplifies form work.

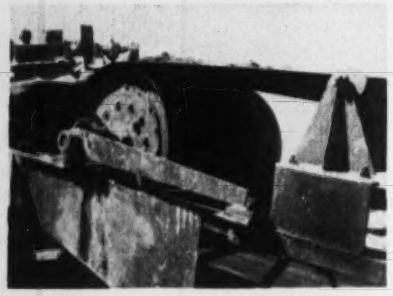
Made in Canada for J. E. Goodman Sales Ltd.
Toronto, Ontario

WATER SEALS, INC.
9 South Clinton Street Dept. 1
Chicago 6, Illinois

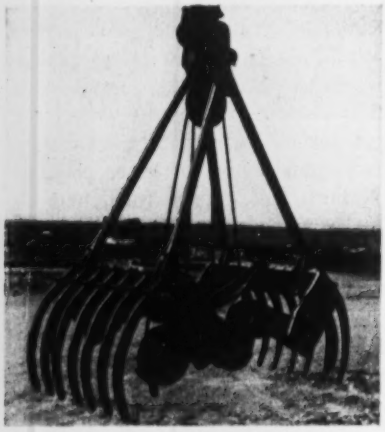
Please send complete information on Labyrinth Waterstops.

Name_____
Company_____
Address_____
City_____ Zone____ State____

YUBABILT BULL GEARS with 12" face and outside diameter of 146", for main drive gears on bucket line of bucket ladder dredge. Welded construction saved cost of new patterns.



YUBA-SCHROCK MOTORIZED HEAD PULLEY has motor mounted internally, eliminates all external gears, sprockets, chains, saves space, operates safely under wet, dusty, gritty conditions. ½ to 125 hp.



STOCKTON-YUBABILT TINE FORK for handling kelp, steel shavings, etc., has same powerful closing action as Yubabilt Power Arm Clamshell.

For special equipment, designed and built to your order, consult YUBA.

77

YUBA DREDGES — PROVED DEPENDABILITY AROUND THE WORLD

YUBA MANUFACTURING CO.

Room 716 • 351 California St. • San Francisco 4, Calif.

Equipment, Materials & Methods (Continued)

Work Kit

A METHOD FOR predetermining the time necessary for Fork Lift Trucks to perform specific operations has been provided in a Work Kit which will enable plants to apply Fork Lift Truck standard performance data. Included in the kits, which are available without cost, are typical materials handling examples to demonstrate the standard technique for application of the data as well as charts that provide times for the basic truck motion elements. Also included in each kit are a quantity of work sheets which can be used in the evaluation of standard performance times for specific fork truck operations. Data which have been developed has been divided into two major sections—basic time values and variable factors. **The Yale & Towne Mfg. Co., CE 11-120, 11,000 Roosevelt Blvd., Philadelphia 15, Penna.**

Water Level

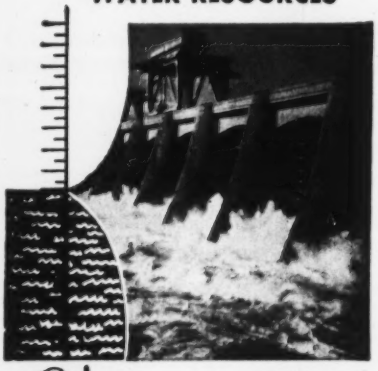
THE NEW LEVELEASY compactly combines a fluid reservoir, tube reel, and a 50 ft clear plastic tube in handy $6^{1}/_{8}'' \times 3^{1}/_{4}''$ aluminum container. The 50 ft tube permits extending a level line for 100 ft. Accurate, dependable and easy to operate, its low cost is explained by its simple design. This simplicity of design makes the leveleasy a mechanic's tool. It has no delicate parts to get out of order and can be kept close to the job without fear of damage, thus eliminating costly delays for level shots. It is ideally practical as a secondary level on multiple jobs or for the small builder who needs such a hydrostatic level only occasionally. It offers a speedy and accurate method of setting batters and grade stakes, insures level tile, terrazzo and concrete floors, and is a real time saver in masonry work as well as form erection or setting screeds. The new unit also represents a quick and simple method of contour leveling on the farm or in general landscape work. **Hydrolevel, CE 11-120, 53 De Soto, Ocean Springs, Miss.**

Timberline Truss Designs

THREE TYPICAL DESIGNS of segmental bowstring timber trusses, having spans of 30, 40 and 50 ft, have been completed for the construction industry. Although similar to the Lank-Teco designs in general appearance, the 30 and 40 ft designs Nos. 626 and 627, differ in that they use butt top chord splices, eliminate use of steel rods, and have greater depth. The new 50 ft design, No. 628, has more of the general appearance of a bowstring truss. The new designs are the first of a series of eight new typical timber truss suggestions being prepared by TECO engineers, to serve as guides for architects, engineers and builders planning their light and heavy construction jobs in timber. **Timber Engineering Company, CE 11-120, 3—19-18th St., N. W., Washington 6, D. C.**

BASIC DATA

FOR UTILIZING WATER RESOURCES



With **STEVENS**

WATER LEVEL RECORDERS

graphic, visual or audible registration ... local or remote

The planning of any project which involves the utilization of water resources is based on flow data which can be obtained from STEVENS water level recorders. And STEVENS recorders are equally important in the efficient operation of the completed project.

STEVENS instruments have been a standard of quality since 1907. They are at work compiling data on all major hydroelectric and flood control projects, and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

Consult with STEVENS hydraulic instrument specialists before planning any water measurement or control installation.

STEVEN'S *Data Book*

... a must for your reference file

$1.00 Postpaid

Puts interpretive data at your finger tips. 144 pages of technical data ... information on float wells and recorder installations ... a wealth of hydraulic tables and conversion tables.

Order Your Copy Today L&S INSTRUMENTS

LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. Glisan St., Portland 13, Ore.

Servicised

Resin Base Concrete Curing Compound

- Does not alter appearance of concrete
- Dries rapidly, forms clear, vapor-tight membrane... assures positive control of curing
- Readily accepts paint or adhesives after curing

Servicised Resin Base Curing Compound is recommended for curing exposed concrete such as pavement slabs, bridges, abutments, walls, etc. Sprayed or painted, it forms a uniform membrane capable of holding moisture in the concrete to assure proper curing.

Write for complete details and circular on Servicised Concrete Curing Compounds.

SERVICISED PRODUCTS CORPORATION
6051 West 65th Street, Chicago, Illinois

Fines Separation and Control with HARDINGE HYDRO-CLASSIFIERS

The Hardinge Hydro-Classifier is a large-volume classifier for fine separating problems. It makes an efficient and economical unit, with positive control of the sizing and moisture of both oversize and fines. Separations from 48 mesh to finer than 400 mesh are possible. The coarse materials discharge at the bottom; the fines overflow the weir. May be supplied with screw dewaterer to discharge the underflow in a semi-dry condition. State your classification problem. Bulletin 39-B-37.

HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA · 240 Arch St. · Main Office and Works
New York · Toronto · Chicago · Hibbing · Houston · Salt Lake City · San Francisco

Literature Available

CORE DRILLS—There is now available a bulletin that describes the LD and LLD portable powered core drills. The Model LD combines into a compact unit standard power plant, a built-in cathead hoist, a built-in positive rotary drill head with hand lever feed. The Model LLD is a lightweight unit without a pump, hoist or three-speed transmission, but it has the same rotary drill head. For a free copy of Bulletin 21, write to: **Acker Drill Co., C. E. 11-121, 725 W. Lackawanna Ave., Scranton, Pa.**

DIAPHRAGM PUMP—A new diaphragm pump is described in folders as being capable of 400% more pumping at 25 ft static lift. Since this pump weighs only 130 lbs, one man can handle it. These diaphragm pumps are available as either gasoline engine driven or electric motor driven units and are fully guaranteed. Folders and bulletins showing applications and giving performance data and specifications may be obtained by writing to **The Gorman-Rupp Co., C. E. 11-121, Mansfield, Ohio.**

PRESSURE FILTERS—A comprehensive bulletin describes an extensive line of pressure filters and their accessories. These filters are now being used to remove suspended solids such as dirt, turbidity, iron, oil and color. Specifications, operating characteristics, outline dimensions and typical installation photographs, which should interest engineers dealing with water problems, have been included in this revised edition. For Bulletin No. 2225B write **The Permutit Co., C.E. 11-121, 330 West 42nd St., New York 36, N. Y.**

HAND LIFT PALLET TRUCKS—A 12 page brochure pictures and describes the moving and storing of many types of multi-unit loads by Yale Pallet Hand Lift Trucks. Showing how hand trucks can increase efficiency in handling a variety of materials, the brochure features a section describing different pallet types and gives their specifications. There are also photographs showing operation of both the hydraulic and mechanical lifting mechanisms. Brochure P-673B may be obtained from **The Yale & Towne Mfg. Co., C. E. 11-121, 11,000 Roosevelt Blvd., Philadelphia, Pa.**

MODERN MINING METHODS—A new two-color booklet called "Modern Mining Methods" gives a pictorial review of the industrial equipment as applied by the mining industry. Action photos illustrate the developments in equipment geared to the mechanized operation and to other post-war techniques of the mining industry whether above or underground. They also show how this modern equipment can increase output per man-hour and how its versatility permits year-round use of many units for ultimate operating profits to the mine operator. Booklet MS-977 is now available from **Allis-Chalmers Manufacturing Co., C. E. 11-121, Milwaukee, Wisconsin.**

LEFAX★★★

POCKET SIZE TECHNICAL DATA BOOKS $1.25 EACH

Printed on loose leaf, six hole, 6¾" × 3¾" bound paper, each book contains about 140 pages of technical data, presenting condensed, accurate and essential data for the student, engineer, technical worker and business man.

● ● ●

Architecture	Transformers, Relays, Meters
Home Heating	Hydraulics
Illumination	Surveying
Electrician's Data	Mech. Drawing
Builder's Data	Machine Design
Lumber Data	Machinists' Data
Air Conditioning	Piping Data
General Math.	Surveying Tables
Math. Tables	Trig.-Log Tables
Physics	Metallurgy
Chemical Tables	Analytic Chemistry
Metals	Highway Engineering
Gen'l. Chemistry	Mechanics of Materials
Reinforced Concrete	Power Trans. Mech'y.
Building Construction	Thermodynamic Tables & Charts
Radio	Phys. & Thermodynamic Data
Television & FM	Phys. & Org. Chemistry
Electricity, AC	
Electricity, DC	
AC Motors and Generators	

Write for FREE Catalogs (over 2000 listings). See for yourself how helpful LEFAX can be to you. Send $1.25 for each book, or $6 for any five books listed above, to:

LEFAX, Dept. CIV-7 Philadelphia 7, Pa.

HYDROLOGY HANDBOOK

SOCIETY MANUAL NO. 28
184 pages

Authoritative reference in a growing field

Thirty-three specialists have collaborated to present up to date coverage on

Precipitation
Infiltration
Run-Off
Evaporation and Transpiration

Continuous demand for this manual evidences its wide acceptance by teachers and practicing engineers.

Use this handy order blank

☐ . . . copies paper covers (non members) $3.00 each
☐ . . . . . (members) $1.50 each
☐ . . . cloth . . . . (non members) $4.00 each
☐ . . . . . (members) $2.50 each

Payment is enclosed herewith

Name . . . . . .

Address . . . . . Grade Membership . . . . .

City . . . . . .

TIDE GATES

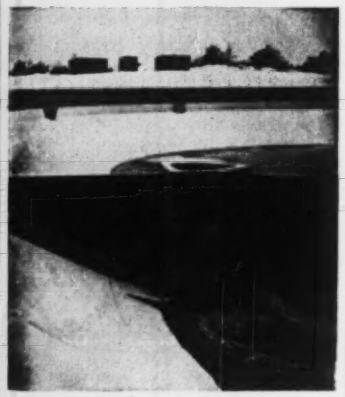


Fig. B-144-A

One of Two 48" Type M Gates installed in Ft. Stanton Park Reservoir, Washington, D. C., to maintain direction of flow. See Feb. 22, 1944, issue Engineering News Record for story about this project.

BROWN & BROWN, INC.
LIMA, OHIO, U. S. A.

Films Available

PROTECTION—The color motion picture "Flamefoil Canvas Protection" is once again available. A dramatic demonstration of the safety and serviceability features of fire, mildew and water resistant canvas which may be utilized in industrial or public service operations; features which the film clearly illustrates under varying climatic conditions and situations. It is highly informative without being too detailed or technical, and for that reason it is also fine entertainment for general audiences in service clubs. "Flamefoil Canvas Protection" is sponsored by the Philadelphia Textile Finishers, Inc. and is available Free-Loan from the **Princeton Film Center, Inc., C. E. 11-122, Princeton, N. J.**

WELDED WIRE—The latest industrial film to tell the story of welded wire reinforcing fabric has recently been released. Photographed in full, natural color, "Reinforced For Life" is one of the most recent attempts by the steel industry at describing on film how welded wire fabric is made, what it is, and why it is so extensively used as a reinforcing element. From manufacture of the basic steel and steel wire to the finished fabric and its diversified applications, "Reinforced For Life" relates the full story of welded wire. Prints of this film are available on a free loan basis by request. **Colorado Fuel and Iron Corporation, C. E. 11-122, P. O. Box 1920, Denver, Colorado.**

CEMENT—A sound and color motion picture film describing the processes involved in the manufacture of cement has been placed into distribution. Entitled "Gray Gold from the Mother Lode", the 16mm film is available without charge to any organized group. Running time of the film is 17 minutes. It traces the history of cement from the earliest days to the present. Typical scenes in the film show tons of rock being blasted from the face of the quarry, grinding of the rock into fine powder and its conversion to slurry. The insides of the company's huge revolving kilns, red-hot at temperatures capable of melting steel, also are shown, and the role of company chemists in controlling the manufacturing process is explained. **Mel J. London, Calaveras Cement Company, C. E. 11-122, 315 Montgomery St., San Francisco 4, Calif.**

TRACTOR TRAILER UNIT—Applications, construction and design features of the new rear-dump PR 21 trailer are described in great detail in a new color strip film just released. No expense has been spared to produce a film that can hold the interest of contractor, miner or quarryman who has use for a high-speed, big capacity rear-dump tractor-trailer unit. Readers are invited to ask for a showing by writing **Athey Products Corporation, C. E. 11-122, 5631 West 65th Street, Chicago 38, Ill.**

PHOENIX BRIDGE COMPANY

Engineers
Fabricators
Erectors

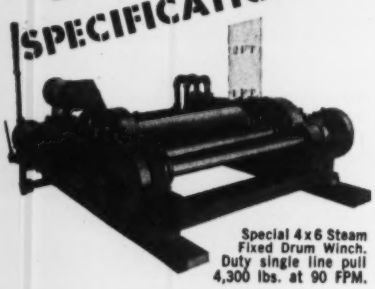
Structural Steel
BRIDGES and BUILDINGS

General Office and Shops

PHOENIXVILLE, PA.

Subsidiary—Barium Steel Corporation

You SET THE SPECIFICATIONS...



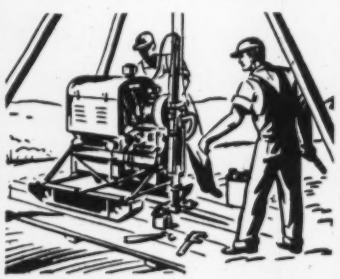
Special 4x6 Steam Fixed Drum Winch. Duty single line pull 4,300 lbs. at 90 FPM.

Superior-Lidgerwood-Mundy has the facilities and experience to meet them . . . either from an all-inclusive line of standard hoisting equipment or with equipment engineered to your specific requirements.

WRITE FOR BULLETINS AND CATALOGS

SUPERIOR LIDGERWOOD MUNDY CORPORATION

Main Office and Works: SUPERIOR, WISCONSIN, U. S. A.
New York Office, 7 Dey Street, New York 7, N. Y.



CONTRACTORS
for
DIAMOND CORE DRILLING
DRY SAMPLE SOIL BORINGS
FOUNDATION TESTING
PRESSURE GROUTING, ETC.
anywhere in the world

More than sixty years of successful experience backed by superior equipment and ample financial resources, constitute your best possible assurance of satisfactory service. Manufacturers, also of Diamond Core Drilling Machines and complete accessory equipment, including all types of Diamond Drilling Bits. Write for Bulletin No. 320.

SPRAGUE & HENWOOD, Inc.
Dept. C. E., SCRANTON 2, PA.

New York - Philadelphia - Pittsburgh
Grand Junction, Col. - Buchans, Newfoundland

PROCEEDINGS AVAILABLE

The following papers have become available as Proceedings-Separates. Following the date of issue of a paper, discussions thereof will be received for a period of three months, as specified on the cover of the paper. Titles will be added to this list every month, as they become available. Technical Division sponsorship is indicated by an abbreviation at the end of each item, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. Papers issued prior to, and including, Separate No. 289, were not distributed under the present automatic mailing system. If you have not registered in a Technical Division to receive its papers (one Division only) free of charge, please do so promptly by filling out and mailing the enrollment and subscription form (page 125) to Society Headquarters. For ordering separate papers, use the convenient order form on page 124.

Listed in Earlier Issues

489. Surface-Water Supply for Irrigation in the Vermilion River Basin, Louisiana, by E. L. Hendricks. (HY)

490. Ground Water in the Vermilion River Basin, Louisiana, by Paul H. Jones. (HY)

491. Discussion of Proceedings-Separates 354, 361, 362, 366, 390, 413, 431, 432. (HY)

492. Waste Disposal at a Steel Plant: General Problems, by Ross Nebolsine. (SA)

493. Waste Disposal at a Steel Plant: Treatment of Sheet and Tin Mill Wastes, by Hugh MacDougall. (SA)

494. Waste Disposal at a Steel Plant: Treatment of Flue Dust Waste, by Angus D. Henderson and John J. Baffa. (SA)

495. Waste Disposal at a Steel Plant: Treatment of Sewage, by John J. Baffa. (SA)

496. Hog Feeding: Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division. (SA)

497. Incineration: Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division. (SA)

498. Garbage Reduction: Report of a Subcommittee of the Committee on Refuse Collection and Disposal of the Sanitary Engineering Division. (SA)

499. Performance of Soils versus Chemical Properties, by C. Kinney Hancock. (HW)

500. Expedient Geometry for the Design of Compound Highway Curves with Connection Spirals, by Robert D. Schacherl and George J. Berindoague. (HW)

501. Discussion of Proceedings-Separates 190, 276, 351, 357. (HW)

502. Problems Encountered in Improving a Deep Water Harbor, by Harry Sugden. (WW)

503. Development of the Delaware River for Commerce, by B. B. Talley. (WW)

504. Discussion of Proceedings-Separates 165, 259, 318. (WW)

505. Improving the Load Carrying Capacities of Subgrades, by Charles M. Noble. (CO)

506. Discussion of Proceedings-Separates 226, 400. (CO)

507. A Steel Plant's Effect on Regional Planning and Development, by Russell VanNest Black. (CP)

508. Philadelphia Capital Budget and Program Procedures, by Charles A. Howland. (CP)

509. History of the City Planning Division of the ASCE, by Harry W. Alexander. (CP)

510. Is Parking a Public Responsibility? by William R. B. Froehlich. (CP)

511. Solving the Engineering Problems of Metropolitan Areas, by G. H. Herrold. (CP)

October

512. Subgrade Soil Classification System Used in Georgia, by L. W. Freeman. (SM) A method of soil classification that deals principally with soils having a maximum density of less than 100 lb per cu ft is described. An attempt is made to show that a knowledge of the volume change (both shrinkage and swell) is vital in predicting the behavior of these soils under changing conditions of moisture and load.

513. Foundation Conditions in the Cuyahoga River Valley, by Ralph B. Peck. (SM) The distribution and physical properties of the glacial deposits beneath part of the industrial section of Cleveland, Ohio, are summarized in this paper, together with the behavior of the subsoil during construction operations and under the weight of heavy structures. The presence and significance of artesian conditions are discussed.

514. Rock-Fill Dam Design and Construction Problems, by D. J. Bleifuss and James P. Hawke. (SM) The paper is confined to a discussion of rock-fill dams having impervious zones of earthen materials. Terminology for various zones is suggested. The importance of thorough investigation of sites and materials is stressed, and reasons are given from the standpoints of the designer and the contractor. Construction problems are discussed; scheduling, river handling, and choice of equipment are mentioned; and foundation treatment and placing of materials in the various zones are considered in some detail.

515. Engineering Problems in Columbia Basin Varved Clay, by Fred C. Walker and

INSTRUCTIONS

1. A member is entitled to 100 different papers during a fiscal year.

2. Papers should be ordered by serial number. The member should keep a record of Separates ordered to avoid unwanted duplication.

3. Members' accounts will be charged 25¢ each for additional copies of a paper.

4. Every ASCE member registered in one of the Technical Divisions will receive free and automatically all papers sponsored by that Division. **Such registration will be effective the first of the month following the receipt of the registration form.**

5. Non-members of the Society may order copies of Proceedings papers by letter with remittance of 50¢ per copy; members of Student Chapters, 25¢ per copy.

Standing orders for all Separates in any calendar year may be entered at the following annual rates: Members of ASCE, $12.00; members of Student Chapters, $12.00; non-members, $20.00, plus foreign postage charge of $0.75; libraries, $10.00.

TRANSACTIONS. Specially selected PROCEEDINGS papers with discussions will be included in TRANSACTIONS. Annual volumes of TRANSACTIONS will continue to be available at the currently established annual subscription rates.

	To Members	To Non-Members
Morocco-grained binding	$4.00	$18.00
Cloth binding	3.00	17.00
Paper binding	2.00	16.00

W. H. Irwin. (SM) The Nespelem deposits in the Columbia River Basin are composed of a material that has had a profound effect on engineering problems in this area. The solution of these problems has required considerable ingenuity in specific cases. Experiences with the varved clays have served to emphasize the deficiencies in classical design and testing procedures. In particular, they have demonstrated the need for a thorough study of geology and soil mechanics in order to provide solutions to the engineering problems.

516. Engineering Properties of Expansive Clays, by W. G. Holtz and H. J. Gibbs (SM) Expansive clay soils exist at several hydraulic-structure sites of the United States Bureau of Reclamation. As the foundations are eventually saturated, expansion effects are greatly magnified. The paper includes a discussion of identification methods, laboratory tests, engineering properties, and change in properties with changing conditions. Detailed examples of actual problems and solutions are given.

517. Recent Trends in Hydraulic Gate Design, by D. A. Buzzell. (PO) In the past eight years the Corps of Engineers has developed and tested several types of sluice, crest, and intake gates which are important contributions to engineering knowledge and practice. All the gates described in the paper, except the skimming tainter gate, have proved in service to be satisfactory from an engineering standpoint. The most successful gate is an improved hydraulically-operated slide gate, which has been operated under 285 ft of head, and an eccentric trunnion tainter sluice gate designed for 200 ft of head.

518. Discussion of Proceedings-Separates 325, 328, 360, 363. (SM)

519. Design Rainfall: Central and Southern Florida Project, by L. A. Farrer. (IR) The economic and design analyses of many sections of the Central and Southern Florida Project are based on frequency studies. The paper describes the study which was made in order to determine the probability of the future occurrence of rainfall of various amounts and durations in central and southern Florida.

520. Hydrology Characteristics: Central and Southern Florida Project, by Angelo Tabita. (IR) In connection with the planning and design of the water-control works contained in the project, the principal hydrologic factors of rainfall, runoff, evapo-transpiration, infiltration, and ground-water storage are resolved to solve problems relating to the regulation, control, and utilization of water. The paper is concerned principally with climatic characteristics, the behavior of surface and ground water within the project area, the methods of collecting basic water-level and stream-flow data, and the analysis and use of such data.

521. Water Control in Central and Southern Florida, by Harold A. Scott. (IR) In the paper are contained the historic efforts made to provide drainage and water control to central and southern Florida. Distribution and utilization of water in the Comprehensive Plan for flood control and multiple purposes are described. The need for a secondary water-control plan is emphasized.

522. Discussion of Proceedings-Separates 280, 369, 426. (IR)

523. Discussion of Proceedings-Separates 241, 424. (AT)

524. A Modern Military Grid System, by Floyd W. Hough (SU) Efficient fire control under battle conditions requires a plane rectangular coordinate system with the property of conformality. In 1947, the United States Army adopted the Universal Transverse Mercator projection as most suitable for this purpose. Implementation involves the mass conversion of geodetic data and reduction to a common datum which is currently being done by the Army Map Service.

525. Discussion of Proceedings-Separates 277, 305, 393, 407, 415. (SU)

526. Verification of Theory for Oblique Standing Waves, by Arthur T. Ippen and Donald R. F. Harleman. (EM) A series of experiments were undertaken to verify the hydrodynamic theory for both oblique hydraulic jumps and expansion waves with Froude numbers ranging from two to seven. The position of the standing waves caused by a wall deflection and the associated depth changes were observed and compared with existing theory. The average agreement was of the order of two for the expansions. An analysis of the nature of the transition between undular-type and roller-type jumps is also presented.

527. Lateral Buckling of Cantilevered I-Beams Under Uniform Loads, by Stanley Poley. (EM) In this paper the differential equation and boundary conditions are derived which describe the lateral buckling of a cantilevered I-beam subjected to a uniform load. The resulting boundary-value problem, intractable by purely analytical methods, is solved numerically with the aid of the IBM Card Programmed Calculator; the results are presented therein.

528. Analog Computers Applied to Elastic-Plastic Systems, by Leo Schenker and Gunther Martin. (EM) A circuit is described by the use of which differential analog computers can be adapted to solve the equations of motion of systems incorporating springs with elastic-plastic resistance characteristics. The application of the method to a single-degree-story structure is described and illustrated. The circuit can be used in conjunction with multi-degree-of-freedom systems with or without viscous damping. Interesting possibilities for further research are briefly discussed.

529. Beam Restraints Provided by Walls with Openings, by I. A. Mohammed and E. P. Popov. (EM) A wall is idealized as an elastic plate. The response of the wall to a locally applied edge moment, which simulates a shallow beam, is determined analytically. The solution is checked experimentally and then extended to cases in which the plate has various size openings. The results are presented in design charts.

530. Discussion of Proceedings-Separates 199, 223, 250, 258, 286, 287. (EM)

531. Buckling in the Elasto-Plastic Range, by Vincenzo Franciosi. (EM) A safe value of the buckling load for a beam in the plastic range is rigorously proved to be given by the tangent modulus theory of Engesser rather than by the double-modulus theory of von Kármán as previously shown by Shanley for a simplified beam model.

532. Discussion of Proceedings-Separates 292, 330. (EM)

533. Foundation Problems of Kerr No. 3 Hydro Plant, by H. H. Cochrane and R. A. Sutherland. (PO) A difficult foundation problem of constructing an extension to an existing powerhouse in a deep cleft in the rock river bed was successfully overcome by a process of grouting rock and gravel fill. To conserve space a truncated draft tube design was used. An unusual arch cofferdam was used to isolate and unwater the working area.

For the Use of ASCE Members Only
PROCEEDINGS PAPERS ORDER FORM

AMERICAN SOCIETY OF CIVIL ENGINEERS
33 W. 39 ST., NEW YORK 18, N.Y.

Enter my order for separate PROCEEDINGS Papers which I have circled below.

489	490	491	492	493	494	495	496	497	498	499	500	501	502	503
504	505	506	507	508	509	510	511	512	513	514	515	516	517	518
519	520	521	522	523	524	525	526	527	528	529	530	531	532	533

If more than one copy of a paper is desired (for which a charge of 25¢ per copy will be levied) indicate here:

Name (*please print*) Membership Grade

Address

Signature Date

Professional Services

Listed alphabetically by states

EWIN ENGINEERING CORPORATION
Consulting Engineers
Investigations, Reports, Appraisals, Estimates and Management Surveys, Port Facilities, Foundations, Industrial Plants, Bridges and Structures
General Offices **Mobile Ala.**

PALMER & BAKER, INC.
Consulting Engineers and Architects
Tunnels — Bridges — Highways — Airports — Industrial Buildings — Harbor Structures — Vessels, Boats & Floating Equipment — Soils, Materials & Chemical Laboratories
Mobile, Ala. **New Orleans, La.**
Harvey, La.

JOHN S. COTTON
Consulting Engineer
Hydroelectric, irrigation, water supply, and multiple purpose projects, flood and erosion control, river basin development planning, dams and their foundations, tunnels, marine structures, valuations, rates.
28 Brookside Drive, San Anselmo, Calif.

DAMES & MOORE
Soil Mechanics Engineering
Los Angeles • San Francisco
Portland • Seattle • Salt Lake City
Chicago • New York
London
General Offices, 816 West Fifth Street
Los Angeles 17, Calif.

FAIRCHILD AERIAL SURVEYS INC.
Aerial Photography • Contour Maps
Explorations Surveys • Airborne Magnetometer Surveys • Shoran Mapping
• City Maps • Highway Maps
224 E. 11th St., Los Angeles 15
4630—30 Rockefeller Plaza, New York
Boston **Seattle**

D. B. GUMENSKY
Civil and Structural Engineer
Investigations, planning, location design, construction, costs.
Hydro-electric power, water supply dams, tunnels, sewerage and irrigation, unusual structures.
Domestic and foreign.
1047 Sierra St., Berkeley, Calif.
Tel. Landscape 6-10183

INTERNATIONAL ENGINEERING COMPANY INC.
Engineers
Investigations—Reports—Design
Procurement—Field Engineering
Domestic and Foreign
74 New Montgomery St.
San Francisco 5, California

MAURSETH & HOWE
Foundation Engineers
Soil Investigations – Laboratory Testing
Consultants – Engineering Geology
Construction Supervision
Offices and Laboratories: **8953 Western Ave. Los Angeles 47, Calif.**
Eastern Associate: **George R. Halton Newark, N. J.**

KAISER ENGINEERS
Division of Henry J. Kaiser Company
ENGINEER – CONTRACTOR
Investigations – Reports – Valuations
Design – Construction
Twinoaks 3-4600
1924 Broadway **Oakland, Calif.**

ENGINEERING SERVICES INC.
Foundation Investigations—Complete Test Boring Service—Field and Laboratory Soil Testing—Mineral Resource Explorations
119 New London Tnpk., Glastonbury, Conn.

DUVAL ENGINEERING & CONTRACTING CO.
General Contractors
FOUNDATION BORINGS
For Engineers and Architects
Jacksonville **Florida**

RADER ENGINEERING CO.
Water Works, Sewers, Refuse Disposal, Ports, Harbors, Flood Control, Bridges, Tunnels, Highways, Airports, Traffic, Foundations, Buildings, Reports, Investigations, Consultations
111 N.E. 2nd Avenue **Miami, Florida**

ALVORD BURDICK & HOWSON
Consulting Engineers
Water Works, Sewerage, Water Purification, Sewage Treatment, Flood Relief, Power Generation, Drainage, Appraisals
20 North Wacker Drive, Chicago 6, Ill.

CONSOER, TOWNSEND & ASSOCIATES
Water Supply, Sewerage, Flood Control & Drainage, Bridges, Express Highways, Paving, Power Plants, Appraisals, Reports, Traffic Studies, Airports, Gas and Electric Transmission Lines
351 East Ohio Street, Chicago 11, Ill.
9½ Indiana St., Greencastle, Ind.

KORNACKER & ASSOCIATES, INC.
Engineers
Bridges, Highways, Expressways and Railways, Building Structures, Industrial Plants, Supervision, Foundations and Soils, Investigations and Reports, Sewerage and Sewage Disposal, Surveys.
53 W. Jackson Blvd. **Chicago 4, Ill.**

DeLEUW, CATHER & COMPANY
Consulting Engineers
Transportation, Public Transit and Traffic Problems
Industrial Plants, Grade Separations Railroads, Subways, Power Plants, Expressways, Tunnels, Municipal Works
150 N. Wacker Drive, Chicago 6, Ill. **79 McAlister St. San Francisco 2**

GREELEY AND HANSEN
Samuel A. Greeley, Paul E. Langdon, Thomas M. Niles, Kenneth V. Hill, Samuel M. Clarke
Richard H. Gould
Water Supply, Water Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes
220 S. State Street, Chicago 4, Ill.

HARZA ENGINEERING COMPANY
Consulting Engineers
Calvin V. Davis **E. Montford Fucik**
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development
400 West Madison Street, **Chicago 6**

SOIL TESTING SERVICES, INC.
Carl A. Metz
John P. Gnaedinger
Foundation Borings
Field and Laboratory Tests of Soils
Analyses and Reports
3529 N. Cicero Ave., Chicago 41, Ill.
1844 N. 35th Street, Milwaukee, Wisc.
1105 E. James Street, Portland, Mich.

JENKINS, MERCHANT & NANKIVIL
Consulting Engineers
Municipal Improvements — Sewerage
Power Development — Water Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Airports — Investigations and Reports
805 East Miller Street
Springfield, Illinois

NED L. ASHTON
Consulting Engineer
Bridges, Swimming Pools, Welded Structures & Foundations, Design & Strengthening.
820 Park Road, **Iowa City, Iowa**

STANLEY ENGINEERING COMPANY
Consulting Engineers
Airports — Drainage — Electric Power
Flood Control — Industrial-Rate Studies
Sewerage — Valuation — Waterworks
Hershey Building, Muscatine, Iowa

HAZELET & ERDAL
Consulting Engineers
Bridges — Foundations
Expressways — Dams — Reports
Monadnock Block
Chicago
403 Commerce Bldg., Louisville
Dixie Terminal Bldg., Cincinnati

EUSTIC ENGINEERING COMPANY FOUNDATION AND SOIL MECHANICS INVESTIGATIONS
Soil Borings *Laboratory Tests*
Foundation Analyses *Reports*
3635 Airline Highway
New Orleans 20, La.

WHITMAN, REQUARDT AND ASSOCIATES
Engineers
Sewerage and Water Systems, Highways, Airports, Industrial and Power Plants and Other Structures
Reports — Designs — Specifications — Supervision
1304 St. Paul Street, Baltimore 2, Md.

CRANDALL DRY DOCK ENGINEERS, INC.
Railway Dry Docks, Floating Dry Docks, Basin Dry Docks, Shipyards, Port Facilities
Investigation, Reports, Design Supervision
238 Main St., Cambridge 42, Mass.

IRVING B. CROSBY
Consulting Engineering Geologist
Investigations and Reports
Dams, Reservoirs, Tunnels, Foundations, Groundwater Supplies and Resources
Non-Metallic Minerals
6 Beacon Street
Boston 8, Massachusetts

JACKSON & MORELAND
Engineers and Consultants
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications
Boston **New York**

Enrollment and Subscription Form

(now am)
I (wish to be) enrolled in the_____
Division and receive automatically and WITHOUT CHARGE all of the "Proceedings" Separates issued under the auspices of this Division.

My current mailing address is as follows:

_____
(Signature)

_____
(Membership Grade) (Date)

_____
(Street)

_____
(City) (State)

Professional Services

Listed alphabetically by states

METCALF & EDDY
Engineers
Investigations Reports Design
Supervision of Construction
and Operation
Management Valuation Laboratory
Statler Building
Boston 16

BENJAMIN S. SHIENWALD
Architectural Consultants
on
Engineering Projects
Design—Supervision—Reports
85 South Street, Boston 11, Mass.

The Thompson & Lichtner Co., Inc.
Civil and Industrial Engineers
Design, Supervision, Testing,
Engineering and Production Studies
Special Structures, Tunnels, Airports,
Highways, Foundations.
Office and Laboratory—Brookline, Mass.

Abrams Aerial Survey Corporation
Photogrammetric Engineers for more than a third of a century
Aerial Photography—Atlas Sheets—
Mosaics—Plan and Topographic Maps—
Profiles—Infra-red foliage Analysis
Photo-Interpretation Instruments
620 E. Shiawassee St., Lansing, Mich.

BLACK & VEATCH
Consulting Engineers
Water—Sewage—Electricity—Industry,
Reports, Design Supervision of Construction Investigations, Valuation and Rates
4706 Broadway Kansas City 2, Mo.

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City 2, Mo. Cleveland 14, Ohio
P. O. Box 7088 1404 E. 9th St.

GUNITE CONCRETE & CONSTRUCTION COMPANY
Engineers—Cement Gun Specialists—Contractors
Linings, Encasing, Insulating, Repairing,
Fireproofing, Renovating,
New Construction
1301 Woodswether Rd., Kansas City 5, Mo., 2016 West Walnut St., Chicago 12, Ill., 2036 Addison, Houston 25, Texas, St. Louis, Minneapolis, Denver, New Orleans

SVERDRUP & PARCEL, INC.
Consulting Engineers
Bridges, Structures and Reports
Industrial and Power Plant
Engineering
Syndicate Trust Bldg., St. Louis 1, Mo.
220 Bush Street, San Francisco 4, Cal.

A. L. ALIN
Consulting Engineer
5927 N. 24 St.
Omaha, Nebraska
Dams, Hydroelectric Power
Flood Control

EDWARDS, KELCEY AND BECK
Consulting Engineers
Survey — Reports — Economic Studies — Transportation, Traffic — Design — Supervision — Management — Port and Harbor Works—Terminals—Expressways — Highways — Grade Separations — Bridges—Tunnels—Water Supply
3 William Street, Newark 2, N. J.
New York Boston Philadelphia

PORTER, URQUHART & BEAVIN
O. J. Porter & Co.
Consulting Engineers
Airports—Highways—Dams—Structures
Foundations—Stabilization—Pavements
415 Frelinghuysen Ave., Newark 5, N. J.
76 Ninth Ave., New York 11, N. Y.
3568 West Third St., Los Angeles 5, Calif.
516 Ninth St., Sacramento 14, Calif.

LOCKWOOD, KESSLER & BARTLETT, INC.
Engineers Surveyors
Civil Engineering Investigations, Reports and Designs, Supervision of Construction
Cadastral, Geodetic, Topographic & Engineering Surveys, Photogrammetric Engineering and Mapping
375 Great Neck Rd., Great Neck, N. Y.

B. K. HOUGH
Consulting Engineer
Soil & Foundation Engineering
Site Investigation, Soil Testing, Design Analysis for Earthworks, Foundations and Pavements, Field Inspection, Engineering Reports, Consultation.
121 E. Seneca St. Ithaca, New York

AMMANN & WHITNEY
Consulting Engineers
Design and Construction Supervision of Bridges, Highways, Expressways, Buildings, Special Structures, Airport Facilities
76 Ninth Avenue New York 11, N. Y.
724 E. Mason Street Milwaukee 2, Wisc.

BOGERT AND CHILDS
Consulting Engineers
Clinton L. Bogert Fred S. Childs
Ivan L. Bogert Donald M. Ditmars
Robert A. Lincoln Charles A. Manganaro
William Martin
Water and Sewage Works ● Refuse Disposal ● Drainage ● Flood Control ● Highways & Bridges ● Airfields
624 Madison Ave. New York 22, N. Y.

BOWE, ALBERTSON & ASSOCIATES
Engineers
Sewage and Water Works—Industrial Wastes — Refuse Disposal — Municipal Projects—Industrial Buildings—Reports Plans — Specifications — Supervision of Construction and Operation—Valuations
Laboratory Service
110 William Street, New York 38, N. Y.

FRANK E. EHASZ
Consulting Engineers
Structures, Bridges, Airports, Parkways
Design, Supervision of Construction
Investigations, Reports
730 Fifth Avenue, New York 19, N. Y.

HARDESTY & HANOVER
Consulting Engineers
Long Span and Movable Bridges, Hanover Skew Bascule, Grade Eliminations, Foundations, Expressways and Thruways, Other Structures, Supervision, Appraisals, and Reports.
101 Park Avenue, New York 17, N. Y.

FREDERIC R. HARRIS, INC.
Consulting Engineers
Harbors, Piers & Bulkheads, Drydocks, Foundations, Soil Mechanics, Industrial Plants, Water Supply, Flood Control, Airports, Highways, Bridges, Power, Sanitary & Industrial Waste Disposal
27 William Street New York 5, N. Y.
Fidelity Phila. Trust Bldg., Philadelphia

HAZEN AND SAWYER
Engineers
Richard Hazen Alfred W. Sawyer
Water Supply and Sewage Works
Drainage and Flood Control
Reports, Design, Supervision of Construction and Operation
Appraisals and Rates
110 East 42nd St., New York 17, N. Y.

HOWARD, NEEDLES, TAMMEN & BERGENDOFF
Consulting Engineers
Bridges, Structures, Foundations
Express Highways
Administrative Services
1805 Grand Avenue 55 Liberty Street
Kansas City 6, Mo. New York 5, N. Y.

KNAPPEN-TIPPETTS-ABBETT McCARTHY
Engineers
Ports, Harbors, Flood Control Irrigation
Power, Dams, Bridges, Tunnels
Highways—Railroads
Subways, Airports, Traffic, Foundations
Water Supply, Sewerage, Reports
Design, Supervision, Consultation
62 West 47th Street, New York City

LEGGETTE & BRASHEARS
Consulting Ground Water Geologists
Water Supply, Salt Water Problems, Dewatering, Recharging, Investigations, Reports.
551 Fifth Avenue, New York 17, N. Y.

MORAN, PROCTOR, MUESER & RUTLEDGE
Consulting Engineers
Foundations for Buildings, Bridges and Dams, Tunnels, Bulkheads, Marine Structures, Soil Studies and Tests, Reports, Design and Supervision.
420 Lexington Ave., New York 17, N. Y.

PARSONS, BRINCKERHOFF HALL & MACDONALD
Engineers
Bridges, Highways, Tunnels, Airports, Subways, Harbor Works, Dams, Canals, Traffic, Parking and Transportation Reports, Power, Industrial Buildings, Housing, Sewerage and Water Supply.
51 Broadway New York 6, N. Y.

E. LIONEL PAVLO
Consulting Engineer
Design, Supervision, Reports
Bridges, Highways, Expressways
Marine Structures, Industrial Construction, Public Works, Airports
7 E. 47th St. New York 17, N. Y.

MALCOLM PIRNIE ENGINEERS
Civil & Sanitary Engineers
Malcolm Pirnie Ernest W. Whitlock
Robert D. Mitchell Carl A. Arenander
Malcolm Pirnie, Jr.
Investigations, Reports, Plans
Supervision of Construction
and Operations
Appraisals and Rates
25 W. 43rd Street New York 36, N. Y.

THE PITOMETER ASSOCIATES, INC.
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurement and Special
Hydraulic Investigations
New York, 50 Church St.

ALEXANDER POTTER ASSOCIATES
Consulting Engineers
Water Works, Sewerage, Drainage, Refuse Incinerators, Industrial Wastes, City Planning
50 Church Street, New York 7, N. Y.

PRELOAD ENGINEERS, INC.
Founded—1934
Consultants in Prestressed Design
Designers of more than 800 prestressed concrete bridges, buildings, tanks and high pressure pipe lines erected in North America since 1934.
3333 Conn. Ave., Washington, D. C.

SEELYE STEVENSON VALUE & KNECHT
CONSULTING ENGINEERS
Richard E. Dougherty, *Consultant*
Manufacturing Plants
Heavy Engineering
Structural Mechanical Electrical
101 Park Ave. New York 17, N. Y.

SEVERUD-ELSTAD-KRUEGER
Consulting Engineers
Structural Design—Supervision—Reports
Buildings—Airports—Special Structures
415 Lexington Ave., New York 17, N.Y.

SINGSTAD & BAILLIE
Consulting Engineers
Ole Singstad David G. Baillie, Jr.
Tunnels, Subways, Highways, Foundations, Parking Garages
Investigations, Reports, Design, Specifications, Supervision
24 State St. New York 4, N. Y.

FREDERICK SNARE CORPORATION
Engineers-Contractors
Harbor Works, Bridges, Power Plants
Dams, Docks and Foundations
233 Broadway, New York 7, N. Y.
Santiago, Chile San Juan, P. R.
Havana, Cuba Lima, Peru
Bogota, Colombia Caracas, Venezuela

D. B. STEINMAN
Consulting Engineer
BRIDGES
Design, Construction, Investigation, Reports, Strengthening, Advisory Service
117 Liberty Street, New York 6, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION
Design, Construction, Reports, Appraisals
Eighty Broad Street, New York 4, N. Y.

Professional Services

Listed alphabetically by states

DUFFILL ASSOCIATES, INC.
Consulting Engineers
80 Boylston St., Boston 16, Mass.

FAY, SPOFFORD & THORNDIKE
Engineers
John Ayer **Ralph W. Horne**
Bion A. Bowman **William L. Hyland**
Carroll A. Farwell **Frank L. Lincoln**
Howard J. Williams
Airports—Bridges—Turnpikes
Water Supply, Sewerage and Drainage
Port & Terminal Works—Industrial Bldgs.
Boston **New York**

JAMES M. CAIRD
Established 1898
C. E. Clifton, H. A. Bennett
Chemist and Bacteriologist
Water Analysis
Tests of Filter Plants
Cannon Building, Troy, N. Y.

CREDLE ENGINEERING COMPANY
Civil Engineers
Structures, Foundations, Soil Borings
Soil Mechanics Investigations, Water & Sewer Systems, Land Surveying
204 E. Markham Av. **Durham, N. C.**

THE AUSTIN COMPANY
Design — Construction — Reports
Plant Location Surveys — Domestic & Foreign Work
16112 Euclid Avenue, Cleveland, Ohio.
New York **Detroit** **Oakland**
Chicago **Houston** **Seattle**
Los Angeles

HAVENS AND EMERSON
W. L. Havens C. A. Emerson
A. A. Burger F. C. Tolles F. W. Jones
H. H. Moseley J. W. Avery
F. S. Palocsay E. S. Ordway
Consulting Engineers
Water, Sewerage, Garbage, Industrial Wastes, Valuations—Laboratories
Leader Bldg. **Woolworth Bldg.**
Cleveland 14, O. **New York 7, N. Y.**

The OSBORN ENGINEERING Company
7016 EUCLID AVENUE **CLEVELAND 3, OHIO**
DESIGNING—CONSULTING
Industrial Plants Office Buildings
Stadiums, Grand Stands, Field Houses
Bridges, Garages, Laboratories
COMPLETE ENGINEERING SERVICE

HENRY R. STAATS
Civil Engineer & Surveyor
Investigations Field Engineering
Surveys Ground Control
Triangulation Preliminary Surveys
Topographical Mapping
2626 S. E. Ankeny **Portland, Oregon**

CAPITOL ENGINEERING CORPORATION
Engineers-Constructors-Management
DESIGN AND SURVEYS
ROADS AND STREETS
SEWER SYSTEMS WATER WORKS
PLANNING AIRPORTS
BRIDGES TURNPIKES DAMS
Executive Offices
Dillsburg, Pennsylvania
Washington, D. C. **Pittsburgh, Pa.**
Dallas, Texas **Paris, France**

GANNETT FLEMING CORDDRY & CARPENTER, INC.
Engineers
Dams, Water Works, Sewage, Industrial Waste and Garbage Disposal—Highways Bridges and Airports, Traffic and Parking —Appraisals, Investigations, and Reports
HARRISBURG, PENNA.
Pittsburgh, Pa. **Philadelphia, Pa.**
Daytona Beach, Fla.

MODJESKI AND MASTERS
Consulting Engineers
F. M. Masters
G. H. Randall **J. R. Glese**
C. W. Hanson **H. J. Engel**
Design and Supervision of Construction
Inspection and Reports
Bridges, Structures and Foundations
State St. Bldg. **Philadelphia, Pa.**
Harrisburg, Pa. **New Orleans, La.**

ALBRIGHT & FRIEL, INC.
Consulting Engineers
Francis S. Friel
Water, Sewage and Industrial Waste Problems, Airfields, Refuse Incinerators, Dams, Flood Control, Industrial Buildings, City Planning, Reports, Valuations—Laboratory
121 So. Broad Street, Philadelphia 7, Pa.

JUSTIN & COURTNEY
Consulting Engineers
Joel B. Justin **Neville C. Courtney**
Dams and Power Problems
Hydro Electric Developments
Foundations
121 S. Broad St. **Philadelphia 7, Pa.**

G. G. GREULICH
Consulting Engineer
Investigations, Reports, Advice.
Pile Foundations, Sheet Piling, Cofferdams, Bulkheads, Piers, Bridge Decks, Bank Vaults. Steel Product Development
609 Gateway Center **140 Stanwix St.**
Pittsburgh 22, Pa.

HUNTING, LARSEN & DUNNELLS
Engineers
Industrial Plants—Warehouses
Commercial Buildings—Office Buildings
Laboratories—Steel and Reinforced Concrete Design—Supervision Reports
1150 Century Bldg., Pittsburgh 22, Pa.

MORRIS KNOWLES INC.
Engineers
Water Supply and Purification
Sewerage and Sewage Disposal
Valuations, Laboratory, City Planning
1312 Park Bldg., Pittsburgh 22, Pa.

GILBERT ASSOCIATES, INC.
Engineers • Consultants • Constructors
READING, PA.
Surveys . Design . Supervision
Sanitary Engineering
Industrials and Utilities
Domestic and Foreign
New York . Washington . Philadelphia
Rome . Manila . Medellin

MICHAEL BAKER, JR., INC.
The Baker Engineers
Civil Engineers, Planners, and Surveyors
Airports—Highways—Sewage Disposal Systems—Water Works Design and Operation—City Planning—Municipal Engineering—All Types of Surveys
Home Office: Rochester, Pa.
Branch Office:
Jackson, Miss. **Harrisburg, Pa.**

C. W. RIVA CO.
Edgar P. Snow **John F. Westman**
Highways, Bridges, Tunnels, Airports, Sewerage, Water Supply, Soil Tests, Reports, Design and Supervision
511 Westminster St. **Prov. 3, R. I.**

JACK R. BARNES
Consulting Ground-Water Engineer
Exploration—Evaluation—Development of Underground Water Supplies
308 W. 15th St. **Tel. 7-5407**
Austin, Texas **53-4751**

WILLIAM F. GUYTON
Consulting Ground-Water Hydrologist
Underground Water Supplies.
Investigations, Reports, Advice.
307 W. 12th St.
Austin 1, Texas **Tel. 7-7165**

ENGINEERS TESTING LABORATORY, INC.
Foundation and Soil Mechanics Investigations
Soil Borings Laboratory Tests
Foundation Analyses Reports
3313 Main St. **Houston, Texas**

GREER & McCLELLAND
Consulting Foundation Engineers
Foundation Investigations — engineering soil testing—undisturbed sampling and core drilling.
2649 N. Main **Houston 9, Texas**
98 Greenwood Ave., Montclair, N. J.

LOCKWOOD & ANDREWS
Consulting Engineers
Industrial Plants, Harbors, Public Works Roads, Airports Structures, Earthworks Mechanical & Electrical
Reports—Design—Supervision
Surveys—Valuations
Corpus Christi—**Houston**—Victoria, Texas

USE THIS PROFESSIONAL CARD DIRECTORY

Participation is restricted to consulting engineering firms operated or controlled by members of the

American Society of Civil Engineers

Now Available

DEFINITIONS OF SURVEYING, MAPPING, AND RELATED TERMS

This Manual of Engineering Practice, No. 34, compiled by a committee of the Surveying and Mapping Division of ASCE, replaces Manual No. 15. The many advances that have been made in the art and science of surveying have made necessary the issuance of this new manual.

Included in the manual are a selected list of useful charts and maps, a bibliography of surveying publications, and a listing of references to surveying, photogrammetry, and other engineering terms.

$1.50 to members
$3.00 to non-members

American Society of Civil Engineers
33 West 39th Street, New York 18, N. Y.

Please send . . . . . copies of Manual No. 34
Enclosed is check (or money order) in the amount of $ . . . . . .
I am (not) a member.

Name . . . . . .

Street . . . . . .

City . . . . . State . . . . . .

Index to Advertisers

Acker Drill Company, Inc. 111
Aero Service Corporation. 101
Allied Structural Steel Companies 20
American Bridge Division. . . . . .98 and 99
American Cast Iron Pipe Company. 91
American Concrete Pipe Association 100
American Concrete Pressure Pipe Association. 96
American Steel & Wire Division. 5
Armco Drainage & Metal Products, Inc. 86
Austin-Western Company 21

Barber-Greene Company 15
Bethlehem Steel Company 87
B-I-F Industries, Inc. 24
Bludworth-Marine, Division of National-Simplex Bludworth, Inc. 115
Borden Metal Products Company. 2
Brown & Brown, Inc. 122

Cast Iron Pipe Research Association. . . . . 12 and 13
Cement Gun Company 114
Chicago Bridge & Iron Company 19
Chicago Pump Company. 90
Columbia-Geneva Steel Division. . . . . .5, 98 and 99
Concrete Reinforcing Steel Institute. 97
Copperweld Steel Company 106

Drilled-In Caisson Corporation. 114

Eastman Kodak Company 83
Eimco Corporation . . . . . .9 and 17

Fairchild Aerial Surveys, Inc. 108
Fennel Instrument Corp. of America. 117
Flexible Road Joint Machine Company . . . . . .88 and 89
Flexible Sales Corporation. 25
Flint Steel Corporation. 118
Flynn and Emrich Co. 118

General Electric Company 10
Geo-Optic Company, Inc. 119
Griffin Wellpoint Corp. 103
C. L. Guild Construction Co. 18
W. & L. E. Gurley 105

Hardinge Company, Incorporated 121

The Ingalls Iron Works Company. 93
International Harvester Company . . . . . .28 and 29
Irving Subway Grating Co., Inc.. 117
Imperial Tracing Cloth. 106

Johns-Manville Corporation. 8

Keuffel & Esser Co. . . . . .81 and 106

Laclede Steel Company 23
Layne & Bowler, Inc. 11
Lefax. 121
Leupold & Stevens Instruments, Inc 120
The Lincoln Electric Company 107
Link-Belt Company 14
Lock Joint Pipe Company. . . . . .4th cover
Lone Star Cement Corporation. 32

The Master Builders Co. . . . . .3rd cover
Moretrench Corporation 92

National Clay Pipe Manufacturers, Inc. 1
Naylor Pipe Company. 104

The Permutit Company 85
Philadelphia Gear Works, Inc. 30
Phoenix Bridge Company 122
Pittsburgh-Des Moines Steel Co 7
Proportioneers, Inc. 24

Raymond Concrete Pile Co.. . . . . .2nd cover

Sauerman Bros., Inc. 111
Servicised Products Corp. 121
Simplex Valve and Meter Company 110
Sika Chemical Corp. 22
S. Morgan Smith Co. 4
Solvay Process Division, Allied Chemical & Dye Corporation . 115
Sonoco Products Company . . . . . .26 and 27
Spencer, White & Prentis, Inc.. 119
Sprague & Henwood, Inc. 122
Standard Oil Co. (Ind.) 102
Superior Concrete Accessories, Inc.. 95
Superior-Lidgerwood-Mundy Corporation 122

Tennessee Coal & Iron Division. . . . . .5, 98 and 99

Union Metal Manufacturing Co. 16
United States Pipe and Foundry Co. 6
United States Steel Corporation . . . . . .5, 94, 98 and 99
United States Steel Export Corporation. . . . . .5, 98 and 99
Universal Atlas Cement Company 94

Warren-Knight Co. 115
Water Seals, Inc. 119
David White Company 109
Wild Heerbrugg Instruments, Inc. 107

Yuba Manufacturing Co.. 120

Professional Services . . . . . .125, 126 and 127

Advertising Manager

James T. Norton

33 West 39th Street — New York 18, N. Y.

Representatives

EASTERN

- ROBERT S. CYPHER
  33 West 39th St., New York 18, N. Y.

MID-WESTERN

- DWIGHT EARLY AND SONS
  100 North La Salle St., Chicago 2, Ill.

WESTERN

- McDONALD-THOMPSON COMPANY
  625 Market St., San Francisco 5, Calif.

  3727 West Sixth St., Los Angeles 5, Calif.
  National Building,
  1008 Western Ave., Seattle, Wash.
  3217 Montrose Boulevard, Houston 6, Texas
  Colorado National Bank Bldg., Denver 2, Colo.

sound decision in **1940**

Marion, Indiana Sewage Treatment Plant. Engineer—Consoer, Townsend & Associates, Chicago, Illinois; Contractor—Steigerwald & Borchert, Milwaukee, Wisconsin. Concrete produced with Pozzolith.

resulted in sound concrete **1954**

*design with lowest unit water content ...for maximum quality

For a given set of materials, air content and water-cement ratio, the *unit water content* (amount of water per cubic yard of concrete) is one of the most important basic factors affecting the quality of concrete. Leading authorities agree on this†.

Among the tools employed by engineers in line with this fact is Pozzolith—a proved means of lowering unit water content to insure minimum shrinkage, longer life.

How water content is reduced by Pozzolith for a given placeability is demonstrated quickly at your job—or even at your desk—while you watch. Or if you stipulate a low water content, the effectiveness of Pozzolith in aiding placeability—otherwise unobtainable—is immediate.

May we demonstrate these facts to you?

†See Bureau of Reclamation Concrete Manual, 5th Edition, Page 130.

POZZOLITH ...

the cement-dispersing, water-reducing agent, developed by The Master Builders Co. in 1932, which makes available the optimum amount of air in concrete and fully complies with the water-cement ratio law. Added at the mixer.

the MASTER BUILDERS Co.

Subsidiary of American-Marietta Company

● Installing a 30" Lock Joint distribution line in a tight spot in the streets of Richmond, Va.

LOCK JOINT

the ideal pressure pipe for distribution systems...

New modern equipment, which permits the easy tapping of concrete pipe, has brought about a great demand for Lock Joint Concrete Pressure Pipe in water distribution systems.

Because of its extremely long life and low maintenance requirements, Lock Joint Pipe is ideally suited for this purpose. Its smooth concrete walls assure permanent high capacity without periodic cleaning, and its conservative design gives maximum safety in congested areas where pipe line failure spells disaster and even minor repairs are difficult and costly.

If your pipe project calls for pressure pipe 16" in diameter or larger, specify Lock Joint, the trouble-free answer to your pressure pipe requirements.

For many years one of the leading producers of sewer, culvert and water supply pipe, Lock Joint also manufactures pressure pipe for:

INDUSTRIAL INSTALLATIONS (Supply, circulating and cooling systems)

SUBAQUEOUS INSTALLATIONS (Water intakes, siphons and sewer outfalls)

WATER WORKS OPERATIONS (Pumping and treatment plant piping)

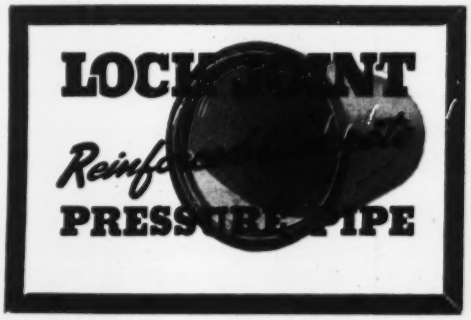
SEWER WORKS OPERATIONS (Sewer force mains and treatment plant piping)

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Kennett Square, Pa. Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. Hartford, Conn. • North Haven, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Ponce, P. R. • Caracas, Venezuela • Wholly Owned Subsidiary, Great Lakes Pipe Co., Plants: Buffalo, N. Y. • W. Henrietta, N. Y.